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BRISBANE

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Edited by
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Review of 1949 Report of Director of Sugar Experiment Stations.

THE 1949 Annual Report of the Bureau of Sugar Experiment Stations was tabled in Parliament on 27th October, 1949. For the convenience of cane growers, the following abstracts have been prepared; these present the major features of the Report, and particularly those of interest to the cane farmer.

1948 Crop Statistics.

With a total crushing of 6,433,556 tons of cane in 1948 a new record was established for the State. The previous highest figure was in 1939, when just over six million tons were treated. As a direct result of the heavy crop the mill crushing periods began early in all cases and were extended beyond the end of the year in 12 factories. Fairymead and Pleystowe, which completed their crushings on the 27th and 28th January, 1949, respectively, were the last two to close down. The crushing periods varied from 13.3 weeks at Rocky Point to 32.9 weeks at Victoria, but the general extent of the period is gauged from the fact that 19 mills had crushing seasons in excess of 25 weeks and 11 of these were in operation for more than 28 weeks. Such extended seasons, continuing as they do into the period of next year's growth, are unfavourable to high sugar production, since the curve of maturity is well past the peak. In contrast with the previous year, when Mackay mills crushed for only 10 to 14 weeks, the eight mills in that district averaged over 25 weeks crushing period.

The yield of sugar for the 1948 season, which includes 153 tons for local sales, was 910,049 at 94 net titre. This is also a new record of production and exceeds the 1947 production by 338,391 tons. For comparative purposes the previous record production in 1939 was 891,422 tons, including local sales. The tremendous increase recorded over 1947 was due in the main to a bounteous season in all centres of production. The quality ratio showed an improvement from 7.26 to 7.07 tons of cane required to make a ton of sugar, but this figure has been improved upon in several previous years. The best recorded ratio was in 1940 with a figure of 6.82.

Further records were established for the production of both cane and sugar per acre. The average sugar cane yield was 24.88 tons per acre and the average sugar produced was 3.52 tons. These figures contrast with the 18.81 and 2.59 of the previous season. Previous record production per acre was in 1939 with figures for cane and sugar of 23.14 and 3.41 respectively. As is usual the Lower Burdekin area exceeded all others in both figures of production, and, for the first time, produced in excess of 5 tons of sugar per acre. When it is considered the the crop consists exclusively of one-year cane, this figure must compare favourably with the world's best. The Bundaberg–Gin Gin district was second in productive capacity, a result which was undoubtedly influenced greatly by C.P.29/116. The average yields of cane and sugar per acre, together with the tonnage crushed in the various districts, are set out in Table IV.

TABLE IV.—TOTALS AND AVERAGE YIELDS BY DISTRICTS, 1948 (DOMESTIC CRUSHING).

District.	Tons of Cane.	Tons Cane per Acre.	Tons 94 n.t. Sugar per Acre.
Mossman-Ingham	2,478,083	24·71	3·56
Lower Burdekin	904,910	34·08	5·14
Proserpine	257,388	24·38	3·46
Mackay	1,409,791	20·67	2·93
Bundaberg-Gin Gin	943,797	28·00	3·64
Childers-Maryborough	321,853	22·33	2·95
Nambour-Beenleigh	117,734	23·70	3·01
	6,433,556	24·88	3·52

Sugar Values, 1948 Season.

The Sugar Board has declared the final price for the 1948 season's sugar as follows:—

—	No. 1 Pool.			No. 2 Pool.	Total.
	Home Consumption.	Surplus.	Total.	Excess.	
Tons	469,081	260,456	729,537	180,358	909,895
Per cent. ..	64·2984	35·7016	100	..	..
	£ s. d.	£ s. d.	£ s. d.		£ s. d.
Price	23 1 0	28 2 0	24 17 0	..	25 9 11

In addition, the values for the New South Wales production were:—

—	Home Consumption.	Surplus.	Total.
Tons	30,740	2,258	32,998
Per cent.	93·1577	6·8423	100
	£ s. d.	£ s. d.	£ s. d.
Price	23 1 0	28 2 0	23 7 11

Calculations from these figures show that the value of the Queensland crop advanced steeply to £23,200,000, which is far in excess of any previous income to the industry. The total value does not bear

any direct relation to production, as the principal factor influencing the average overall price was the high return received for the exportable surplus. In 1939, when the tonnage of sugar produced was little below that of 1948, the total value of the crop was just over £14,000,000, the major difference being that export sugar was sold in that year for £10 7s. 6d. per ton whereas in the season under review the export price was £28 2s.

Review of the Industry.

The production of a record cane and sugar tonnage in the 1948 season confirmed the optimism expressed in the last report as to the future of sugar production in the State. A very favourable year in most areas was mainly responsible for this performance, but at the same time there were various other factors operating which did not allow the maximum benefit to accrue from the propitious climatic conditions. Fertilizer was not in full supply, the field labour was short of demand, and full advantage had not yet been taken of the new varieties, which have shown their superiority over the old standards in all districts. The capacity of existing assigned lands to produce is capable of further exploitation with the better use of newer varieties, and in future years, climatically as favourable as 1948, production can reasonably be expected to exceed previous records.

Expansion of the Peak Sugar Quota.—Probably the most important and far-reaching event during the year was the decision of the State Government to approve the increase of aggregate mill sugar peaks by 187,000 tons of 94 n.t. sugar.

The mill peaks which had been established by the Central Cane Prices Board in 1939 were thus increased to a new aggregate peak of 874,000 tons, and with similar adjustments for New South Wales, bringing that State's peak to 55,000 tons, a new peak ceiling of 929,000 tons of 94 n.t. sugar is provided for. This figure for Australian production should, on the evidence submitted this year, conform to present requirements on the home and export markets and should have a marked influence in stabilising industry economy.

The further provision made by the Central Board to allocate a certain proportion of the increase for new or increased assignments allows for desirable expansion in certain areas and for increased settlement in proximity to existing mill transport systems.

Throughout the industry a considerable degree of satisfaction was expressed regarding the Central Board findings and the Government's decision to implement them. The altered circumstances in many districts during the previous ten years had obviously received serious consideration, and major changes brought about over the same period by the expansion of irrigation and the development of superior varieties doubtless played a major part in the calculation of the new peaks. During that period the industry witnessed extensive varietal changes, which were without parallel in any previous decade, and the relative producing potentialities of many districts were vitally affected by the amazingly rapid development of Trojan, Q.28, Q50, and C.P. 29/116.

The International Sugar Agreement.—During August, 1948, a meeting of the Sugar Council held in London discussed the drawing up of a new International Sugar Agreement, which was strongly advocated by Cuba as a consequence of that country's record outturns in 1947

and 1948. The Council, however, decided to extend the present Agreement for another year and to appoint a committee to study the changes in the world sugar situation. Successive Protocols renewing the Sugar Agreement of 1937 provided for revision of the Agreement when the time appeared opportune, the recognised procedure for revision being that the signatory Governments acknowledge that revision is necessary and that the existing Agreement should be taken as the starting point in any such revision.

The quota provisions of the International Sugar Agreement were inoperative during the war and since, but the Agreement has been extended each year as it was generally considered to be an important basis for the negotiation of any future agreement. There are signs that a crisis may develop in exporting countries within a few years, but this does not necessarily imply that world production will satisfy consumers' demands within that period. There has admittedly been a considerable increase in production, but the demand is being restricted by a scarcity of hard currencies in the principal European importing countries. On the other hand, an increased demand has developed and should continue to develop in countries with large coloured populations, where higher post-war wages are providing greater purchasing power.

Although increased world population figures must, in a broad sense, be taken into consideration in assessing potential demand for sugar, the issue is considerably clouded by political and economic factors. The present situation is complicated by currency problems and this explains why certain large importing countries are unable to provide currency to purchase in dollar markets. For the time being, Australian producers have a measure of safety and security by reason of preferential entry to the British market, but returns from this source could be influenced by sugar surpluses in dollar-producing countries, which would have an effect on the general level of world sugar prices.

Mechanical Harvesting.—The interest in mechanising the harvesting of the cane crop became intensified during the war years, when a short-supplied labour market accentuated manual harvesting problems. Within the past year or so, however, despite a more favourable labour supply, there is no waning but a distinctly greater interest in the subject. The Mechanical Harvesting Committee has sponsored the development and manufacture of the Kinnear machine, and trials with this during the present season are extremely favourable. In other centres the emphasis is being placed on cheap tractor attachments for cutting down but not topping the cane, the aim being to supply small growers who normally harvest their own allotment with a labour-saving device. In the Central district the most favoured type is the Maloney, which harvests and tops but does not bundle, while on larger properties throughout the State the Fairymead harvester, now in commercial production, fulfils the requirements of harvesting and bundling large tonnages. Mechanical loaders are not being concentrated upon to the same extent, although the Committee is still proceeding with the improvements to the Fowler loader. This healthy interest in harvest mechanisation will undoubtedly result in several different types being utilised to cope with the varying field and transport conditions.

Fertilizer.—As a result of representations being maintained throughout the year, one-third more sulphate of ammonia was supplied for use in the cultivation of cane than during the preceding corresponding period, and sales amounted to slightly more than that available

during 1946-47. It is pleasing to note that due to strenuous efforts the State's quota for sulphate of ammonia has been raised from 46.6 per cent. to 50 per cent. of the supply available for use in Australia. International control of sulphate of ammonia was relinquished in June, which is an indication of an easier supply position for the future, but any interruption in the supply of coal will seriously jeopardise the possibility of a continuance of supplies.

An extension to the Queensland superphosphate factory will enable the supply to keep equal to the demand. Meatworks fertilizers are still very short and no alleviation of the position seems possible as supply is related to cattle killings and demand for meat and bone means for stock food. The supply of potash has been equal to the demand and no qualms are felt as to the future of this fertilizer.

The Division of Soils and Agriculture continued its expanded programme of field trials and investigations during the war. Fertility surveys at Fishery Falls, Mourilyan, Proserpine, North Isis, and Mount Bauple gave valuable information on the soil fertility status. It was of interest to note that the available plant food levels in these soils have changed, probably as a result of unbalanced fertilization during the war years. Phosphate content is now, in general, good to fair where potash is mostly poor. The series of lime trials reported on last year again gave valuable results in the first ratoon crop. Of 42 trials harvested 37 gave beneficial responses in either the plant or ratoon crop while 25 gave gains in both crops. The average increase of 3.2 tons of cane per acre could amount to a very large tonnage of cane in the aggregate if lime were applied intelligently to all of the acid soils in these areas.

A series of nitrogen trials laid down in 1947 was also harvested during the year. These had been designed to assess the need for using high nitrogen mixtures at planting time. Sugar Bureau fertilizer mixtures contain only small percentages of nitrogen and it is recommended that, in the absence of a green manure fallow prior to planting, a top dressing of sulphate of ammonia be applied at a time, some months later, when the plant can most effectively use it. The 39 trials harvested, ranging from Mossman to Bundaberg, gave unmistakable evidence that no advantage accrued from the nitrogen application at planting time. It can therefore be concluded that the low nitrogen in Sugar Bureau planting mixtures is based on sound reasoning.

Minor elements again failed to give positive results on sugar-producing soils, and the suspected copper and zinc deficiency on some poor sandy country in the Moreton area has not been definitely confirmed. A larger and more even tract of this "droopy top" affection has been located this year and the opportunity for replicated treatment on a plot scale has been taken. Previous known occurrences of "droopy top" were small and scattered and did not lend themselves to trial treatments. Despite negative results so far obtained in minor element work several more trials have been laid down on the sandy and gravelly, highly leached soils in the high rainfall belt.

Further successful studies of the effects of hormone-type weedicides were made during the year, the emphasis being placed on the pre-emergency effects of 2 : 4 dichlorophenoxyacetic acid and its derivatives and on a general purpose herbicide formulated by the Bureau from diesel oil emulsion, sodium pentachlorphenate and 2 : 4D. The

success of these applications on a small scale led to the designing and manufacture of a boom spray attachment for a tractor for further work under field conditions. Considerable reductions in cost of these materials since the last report bring them within the bounds of economical usage.

Further work on green manure crops was conducted in all districts. The velvet beans again produced excellent crops under a variety of conditions and the drought resistance of these varieties was confirmed. Reeves' Selection and Cristaudo Pea once more demonstrated their resistance to "wilt" and succeeded in growing well under waterlogged conditions. Seed supplies are still difficult to obtain, but it is hoped that the market will see commercial quantities during the coming summer. It is felt that the requirements of Queensland canegrowers are adequately provided for with Poona pea, Giant cowpea, velvet beans, Reeves' Selection, and Cristaudo pea for summer-growing cover crops. These five legumes constitute a group from which can be selected a suitable type for any conditions, including dry and over-wet localities.

In the Burdekin area the development of the new Sugar Experiment Station has been delayed by general shortage of materials, the principal difficulties being associated with fencing materials, electric motors for the irrigation unit, and buildings. It is hoped that land can be prepared and initial cane plantings made in April or May of 1950, but this will naturally be contingent upon the pumping unit being in operation at that time.

Although seedling production proceeded as usual on all stations certain changes in procedure were introduced to improve the type of seedlings being bred and to facilitate as far as possible their propagation in the various districts. In particular in North Queensland much less emphasis is being placed on breeding from noble canes and a greater bias has been given to seedlings with proportions of wild blood. Early maturing types are the principal aim of the plant breeder since this characteristic has assumed even greater importance with the larger crops being grown and the resultant longer crushing seasons. The seedling substations at Bartle Frere and Lansdowne road, Mackay, continued to function and provision has been made for seedling introductions into isolation at Beerwah to provide a greater supply of cane for the Moreton area. It has been felt for some time that the climatic conditions at Nambour were so different from those of Bundaberg that selections at the latter centre were not necessarily suitable types for the Nambour environment.

Further changes of some magnitude and of considerable interest took place in the varietal composition of the crop. The decline of Badila to a mere 18·7 per cent. marks what is probably the final year of a long reign as unchallenged leader. The rise of Trojan, Q.28, and C.P.29/116 to between 12·8 and 16·4 per cent. of the total crop provides an interesting line up of Northern, Central, and Southern district favourites. Queensland-bred varieties rose to 53·5 per cent. of the crop, the principal components of this total being Trojan, Q.28, Q.44, H.Q. 426, Eros, Q.49, and S.J. 16. Q.50, which will be a strong contender for a high place in the list within two years, comprised only 1·4 per cent. of the 1948 crop.

The general disease position in the State showed certain improvements during the year but these were offset by a couple of disturbing discoveries. Early in the year an attempt was made to completely

eradicate downy mildew in the last remaining stronghold of this once major disease. Restrictions were placed on the planting of P.O.J.2878 in the Woongarra area at Bundaberg and so successful was this measure and so widespread have become the plantings of the resistant C.P.29/116 that in the twelve months only 74 stools of downy mildew were found.

Similar restrictions on the planting of P.O.J.2878 at Bingera and in the Moreton area for Fiji disease control also resulted in a marked improvement in the disease position. The planting of extensive areas of Q.47, Q.49, C.P.29/116 and to a lesser extent Vesta and Trojan, is contributing in no small measure to the control in these areas.

The discovery of an outbreak of downy mildew in the Hambledon area during the summer was a rude surprise. No downy mildew had been seen in this area since 1943 and no explanation of the new outbreak can be provided, although the possibility of a carry-over in some alternate host plant cannot be discounted. Inspections and roguings quickly brought the outbreak under control and certain restrictions were imposed on the use of planting material and on the use of susceptible varieties within a half-mile radius of the occurrence. The very high proportion of susceptible varieties now being grown in that area makes it essential that very rigid precautions be continued to prevent further outbreaks or an extension of the existing one.

Although at Mackay the pathologist investigating the Q.28 trouble was able to demonstrate the cause of the ratoon stunting, it was disturbing to learn that a transmissible disease of a new type was responsible. The absence of visible disease symptoms makes identification of healthy and clean plants exceptionally difficult, and inspectors can be guided only by past history of blocks and can confine themselves only to apparently normal ratoon cane. The masking of the ratoon-stunting symptoms under very good or irrigated conditions does not tend to mitigate the difficulty of control. A comprehensive programme of research into this disease is now under way.

A considerable expansion of mercurial dipping of cane setts took place in the Inkerman area during the year. Farm plants capable of treating some 20 tons of cane setts per day are being made locally and growers who have experienced bad germinations as a result of pineapple disease are taking full advantage of this economic and successful method of control.

There was a marked increase in grey-back grub infestations in the far north and also in the Lower Burdekin and Mackay areas. Beetle flights were heavier and the subsequent climatic conditions favoured egg survival. However, overall losses of cane were far below those of previous outbreak years owing to the widespread application of "Gammexane" in areas where grub infestation was anticipated. Some 7,000 acres were dressed with this insecticide and more would have been used had the supply position permitted. There is now no question regarding the efficacy of this control measure, and trials have demonstrated conclusively that 150 lb. of 10 per cent. dust per acre has sufficient residual effect to ensure freedom from damage over the plant and two ratoon crops. It is interesting to record that the first experimental trials with "Gammexane" were laid down in 1945 and the treatment of 7,000 acres three years later is a clear-cut indication of the manner in which the canegrowers in grub-infested areas have adopted the treatment. No single agricultural advance in the industry in the past decade can

compare with this control of our major cane pest. Bureau entomologists have concentrated their efforts on working out details of the control during the past four years and this work is still proceeding in relation to Frenchi grubs and other two-year cycle types.

The second ranking pest in cane fields, the wireworm, has been equally well controlled by the use of 20 lb. of 10 per cent. benzene hexachloride dust per acre mixed with 3 cwt. of the appropriate fertilizer. Although placed in partial contact with the cane setts no depressing effects on germination or ultimate crop yields were noted in a large number of trials. The adoption of this control measure on some 3,000 acres of wireworm-infested land in Mackay demonstrates the success of this practice, and the confidence of the growers in its effectiveness.

Annual Field Days were held at the three Experiment Stations during April and May, when a total of approximately 1,250 growers attended the function. The Annual Pest Board Conference was convened at Mackay in April and Bureau Staff also attended the Conference of the Queensland Society of Sugar Cane Technologists. A conference of Bureau agricultural staff was held at the same time for the formulation and discussion of the field work programme.

SULPHATE OF AMMONIA SUPPLIES.

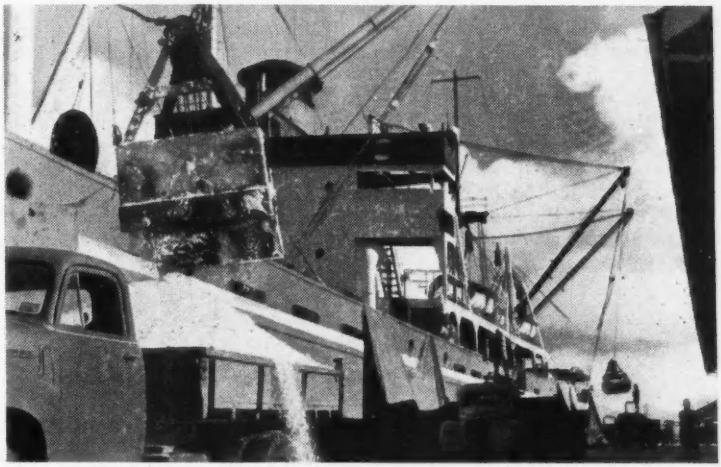
International control of world sulphate of ammonia supplies was withdrawn in June, 1948, and it is to be hoped that this action indicates an easing of the supply position from overseas sources since approximately 50 per cent. of Australian requirements has to be imported. Strong representations on behalf of the sugar industry have resulted in Queensland's share of sulphate of ammonia being increased from 46.6 per cent. to 50 per cent. of the total amount manufactured in Australia and imported from other countries. Sympathetic consideration has been given by the Commonwealth authorities to the ever increasing demand of sugar growers for this fertilizer. The allocation for the six months ending December, 1949, was reasonably good, and, although it was not possible to obtain all that was asked for, it appeared that the industry's chances of getting useful amounts of sulphate of ammonia at an early date were very promising. However, the prolonged coal strike reduced Australian production by an amount calculated to be approximately 10,000 tons. In order to overcome this disastrous drop in production, ways and means were explored to import a further quantity from overseas.

Shipping difficulties, bag shortages and, above all, the necessity for early delivery, made this no easy task. Finally, an offer was received from Russia to supply the required amount within the stipulated period. A serious drawback was that the material was offered as a bulk shipment only. However, those concerned were left with no alternative but to accept in view of the urgent requirement. Accordingly, therefore, the bulk shipment, the first of its kind handled in Queensland, arrived at Cairns in October, where 6,000 tons were unloaded. The ship then proceeded to Brisbane, where the remainder was taken off.

Figure 44 shows the method of unloading at Cairns, where a fleet of motor trucks was utilised to convey the bulk material to a storage shed for subsequent bagging. In Figure 45 may be seen the sulphate

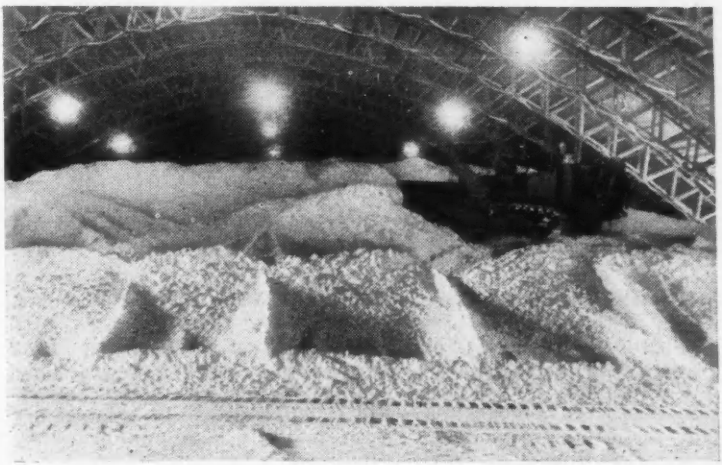
of ammonia being piled into a huge heap by a bull-dozer after being dumped from the motor trucks. Athough many difficulties were associated with the bulk handling of such finely divided material, there is little doubt that growers will appreciate the efforts made on their behalf to ensure early delivery of this essential fertilizer.

—L.G.V.



[*Photo. by courtesy of North Q'land Fert. & Chem. Ltd.*

FIG. 44.—Showing grab loading the bulk shipment of sulphate of ammonia into motor trucks at Cairns.



[*Photo. by courtesy of North Q'land Fert. & Chem. Ltd.*

FIG. 45.—Sulphate of ammonia being piled into a huge heap by a bull-dozer as a preliminary to bagging.

Irrigation in the Sugar Industry.*

By NORMAN J. KING.

IT is commonly, though erroneously, assumed that the sugar cane growing belt in Queensland is one of high rainfall and that the application of additional water, in the form of irrigation, is not practised. It therefore comes as a surprise to many not associated with the industry to find that irrigation of an intensive nature is carried out on such a large area. That great proportion of the State population which does not reside in or near sugar districts is used to reading of the almost annual floods and somewhat less frequent cyclones which plague parts of the sugar areas but it is not so generally known that extensive dry periods occur even in the high rainfall belt despite the annual precipitations of from 150 to 180 inches. Rainfalls such as these, which occur in the Innisfail-Babinda area, are concentrated into the December-May period and the remaining six months are apt to be too dry for good crop development.

FIG. 46.—Illustrating the layout of irrigation drains and furrows in the Burdekin district.

It is not in these high rainfall areas, however, that irrigation is practised. Even though the need is appreciated to tide over dry spells, the capital cost of irrigation plant is high and growers are diffident regarding a high cost installation which may be needed only in particular years.

* A broadcast address through the A.B.C.

In the Lower Burdekin area, not far south of Townsville, and situated around the township of Ayr, high rainfalls do not obtain, the average precipitation being in the neighbourhood of 41 inches. This is below the Brisbane average rainfall, and at the same time the distribution is such that 31 inches normally falls in the four-month December to March period. During the remaining eight months very dry conditions prevail and sugar cane could not grow—nor could normal cultivation proceed—under natural rainfall. The lower Burdekin area is an important one in the State's sugar economy, producing, as it does, one-sixth to one-seventh of the total sugar crop. The rich alluvial soils of the Burdekin River flood plain lend themselves ideally to sugar production and it was discovered very early in the history of sugar growing that vast quantities of underground water existed and that these could be tapped and pumped by means of sub-artesian bores. Underlying this fertile area are deep deposits of water bearing sands and gravels which appear to be replenished, in part, by the annual floodings of the Burdekin River.

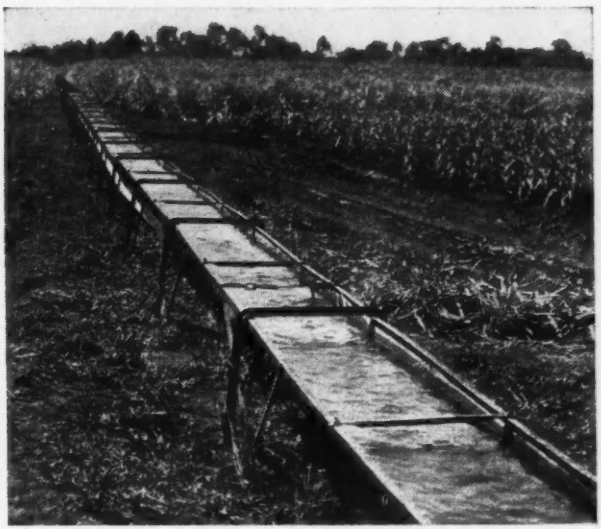


FIG. 47.—Permanent half-round fluming constructed of galvanized iron.

In contrast, therefore, to the normal irrigation system, whereby dammed waters are reticulated by a supply authority to the users of water in a benefited area, the Burdekin canegrowers have their own individual pumping plants. Each farm in the three mill areas of Kalamia, Pioneer and Inkerman, and there are about 550 of them, possesses its own pumping station and power plant. In the two former areas, diesel engines are the principal form of power, but on the Inkerman side of the River electric power is more generally used, the reason for this differentiation being that since the early part of the

century a central power house has operated at Home Hill and supplied power to canegrowers throughout the area. This has now been taken over by the Townsville Regional Electricity Board.

In all three mill areas approximately 25,000 acres of land are irrigated annually, and irrigation to maintain continuous cane growth in a hot and dry climate is an intensive operation. Although it is not practicable to state definitely the amounts of water used, it is probable that each acre irrigated receives upwards of a million gallons of water over and above the natural rainfall. Such an amount of water, spread over some 25,000 acres of land, is as much as the city of Brisbane uses in two and a half years.

FIG. 48.—Showing the manner in which short lengths of 2-inch piping are used to deliver water to the irrigation furrow.

The only other sugar producing area where irrigation has become an important factor in cane production is Bundaberg. There the system is a combination of the river weir and reticulation system and the individual sub-artesian bores. At Bingera the Burnett River is weired and the Bingera Plantation and a considerable number of individual operators pump from the dammed stream. At Fairymead Plantation and on a large number of farms in the several mill areas sub-artesian plants operated by electric and diesel power plants supply the required water. Unlike the Burdekin area, Bundaberg lands are not all located over water bearing drifts and suitable aquifers are restricted. It is estimated that 8,000 acres are irrigated annually in the Bundaberg district and this area of assured crop has a marked stabilising influence on the production of a district which suffers from periodic droughts.

Small scale irrigation has developed in other cane growing districts but it is only in the Burdekin and Bundaberg areas that large scale, intensive watering of cane is carried out. It is estimated that of the 92,000 acres of irrigated land in Queensland 41,560 are devoted to sugar production, so it will be appreciated that the canegrowers are well in the van of agriculturists in exploitation of water resources. As

mentioned previously, sugar production would not be practicable in the Burdekin without irrigation, but, with the use of the underground supplies, a crop valued at just under three million pounds was harvested in 1948.

FIG. 49.—A spray irrigation plant watering young cane at Freshwater, in the Cairns district.

All irrigation of sugar cane is carried out by a furrow system of application. The first watering may be down the planting furrow, but subsequently a drill is made in the interspace between each two rows of cane, and from that time until the harvesting of the crop, some twelve to sixteen months later, all waterings are made in that position. It will be appreciated that to carry out this practice with any degree of precision, the land must first be carefully graded to provide a slight fall for the run of water. The distance the water is allowed to run depends on many factors, the chief of which is the texture of the soil, but the prime requirement is that good vertical and lateral penetration take place and that an ample reservoir of soil moisture results for the needs of the growing crop. Although spray irrigation is much more economical on water, the system has not been adapted to sugar cane lands for several reasons. Spray irrigation plants are very costly when it is desired to cover the large acreages common on cane farms and once the cane grows beyond a certain height the labour required to move spray lines is excessive. Good cane crops are twelve feet or more tall and spray irrigation stand pipes of this size are unwieldly and expensive.

Soils and Plant Nutrition.

BY L. G. VALLANCE.

THE CONSTITUTION OF SOILS.

IT is difficult to formulate a precise definition for that very familiar portion of the earth which is known as "soil." A reasonable definition which is probably as good as any is as follows: "Soil is the superficial, friable layer of the earth's crust which, in conjunction with the atmosphere, is capable of supporting plant life." Soil consists essentially of—

(*a*) Mineral matter which is the result of the breaking down of the original rocks under the prevailing climatic conditions.

(*b*) Organic matter, composed mainly of the residues of the various plants comprising the vegetation which may be natural or otherwise.

(*c*) Soil water, which may contain materials in suspension or solution.

(*d*) Soil air—which is essentially the same as that of the atmosphere, but usually contains more carbon dioxide and water vapour and rather less oxygen and nitrogen.

The Mineral Matter of the Soil.

This is formed of particles which vary considerably in size, from gravel and stones to the very small particles of clay. The larger particles are usually more or less undecomposed rock fragments. The minute particles forming the clay have usually undergone a chemical change in the process of rock disintegration. As would be supposed, therefore, the type of clay present in a soil is directly related to the nature of the original rock and the climatic conditions under which it was decomposed. An important characteristic of the soil is that which is imparted by the size of the mineral particles, and the relative proportions of the different sized particles gives rise to the term *soil texture* which will be further dealt with later.

From the point of view of particle size a soil may be regarded as consisting of varying amounts of four different sized particles. These are (1) Coarse sand, (2) Fine sand, (3) Silt, and (4) Clay. Every soil contains a certain amount of each of these particles in proportions according to the type of soil. As a matter of interest it may be noted that the diameter of the particles of the four fractions are as follows:—

Diameter Limits (Millimetres).	Fraction.
2—1/5th	Coarse sand
1/5th—1/50th	Fine sand
1/50th—1/500th	Silt
Less than 1/500th	Clay

It will be noted that the upper limits are particles of 2 m.m. diameter. Of course, the soil as it occurs in the field will contain particles larger than this. However, as these are chiefly undecomposed fragments of rock or pieces of quartz, they are not regarded as being part of the soil proper. The term *gravel* is usually used to define the smaller fragments of this coarse material which, as is the case for stones and other extraneous matter, is not included in any sample which is to be chemically analysed.

The chemical composition of the soil particles varies according to several factors, the chief of which are the composition of the original rock and the nature of climatic conditions under which the rock was decomposed. In general, however, soil particles show much similarity to the rock from which they are formed and, therefore, may be regarded as complex mixtures of silica, aluminium, iron, lime, magnesia, potash and soda.

Smaller amounts of many other elements such as copper, zinc, manganese, boron, etc., are also present. In most soils, with the notable exception of the red volcanic loams, the coarse sand, fine sand and silt fractions are composed mainly of quartz. This material is particularly resistant to chemical decomposition and, therefore, is able to persist as individual particles. It is interesting to note that while the particles above 1/500th m.m. consist of quartz and undecomposed rock fragments there is a sharp change in the nature of particles which are smaller than this, i.e. the clay fraction.

Clay.

Clay is the chemically active portion of the soil and is the reservoir in which is stored the plant foods which are essential for plant growth. If it were possible to obtain a soil which contained no clay, then this soil would be devoid of available plant food.

Because of its importance the clay fraction of soils has been subjected to a considerable amount of study but owing to the complexity of its structure its exact chemical constitution has yet to be established. In addition to its ability to supply plant food some of the more important agricultural properties of clay may be briefly outlined as follows:—

1. The ability of clay to retain water is very great and because of this it has a marked influence on the moisture holding capacity of a soil. Soils which have a high clay content (such as loams and clay loams) readily retain a very much greater percentage of moisture than soils which are predominantly sandy in nature and contain only a small proportion of clay.

2. Variations in the water content of the clay are accompanied by volumetric changes, i.e., shrinking or swelling. The development of surface cracking of clayey soils which have dried out is a familiar illustration of this fact.

3. Moist clay is characterised by well defined plastic and cohesive properties which are not possessed by the sand and silt fractions. If a mixture of sand and silt is moistened and moulded into the shape of a brick it will crumble and fall apart readily on drying. When, however, even a small amount of clay is present the brick will be considerably resistant to pressure when dry. The clod-forming nature of heavy soils is indicative of this feature, which is agriculturally important from the point of view of tillage operations.

4. Another important feature of clay is its capacity for "flocculation" and "deflocculation." In the absence of substances such as lime or magnesia, clay tends to granulate and form small lumps, i.e. it flocculates. Clays which contain soda disperse or deflocculate into an almost jelly-like state and the soil becomes practically impervious to water. Under these conditions drainage is badly affected and the soil becomes sticky and intractable and considerable difficulty is encountered in cultivation and tillage operations. The use of irrigation water

containing sodium quickly induces such an unfavourable condition. However, the action of less alkaline substances, i.e. lime and magnesia, induce flocculation rather than dispersion. This beneficial action is of well known agricultural value and will be dealt with later.

The Soil Water.

A considerable amount of scientific study has been given to the capacity of a soil to hold water. A fairly simple classification and one which is reasonably accurate is to classify the water held as follows:—

1. Hygroscopic water—not available to plants;
2. Capillary water—available to plants;
3. Gravitational water—drainage water.

Hygroscopic Water.

A soil which has been deprived of all its water by drying in an oven will, when left in contact with the air, take up a certain amount of water from the atmosphere. This is termed hygroscopic water. The amount taken up will depend on the temperature and humidity of the atmosphere and the type of clay. Hygroscopic moisture is held so tightly by the soil that it cannot be extracted by the plants roots and is, therefore, not available for plant growth.

Capillary Water.

If a soil containing only hygroscopic water is thoroughly wetted and allowed to drain freely it will become visibly wet and retains a further amount of water. This is held in comparatively thick films surrounding the soil particles. This is the *capillary* water and while it does not move under gravity and drain away, it is somewhat loosely held by the soil and is, therefore, available for plant growth.

Gravitational Water.

Water which is in excess of hygroscopic and capillary water will be free to move under gravity and is termed gravitational water. This might be more aptly termed the drainage water. As might be expected, there is a close relationship between capillary water and gravitational water and it is not possible to draw a sharp distinguishing line between them. Very often they are grouped together and referred to as vesicular water, since they fill the "vesicles" or small cavities in the soil.

Function of Soil Water.

Water serves several important functions in the life of the growing plant. Some of the major aspects are as follows:—

1. It takes the essential plant food to the vital organs of the plant.
2. Keeps the plant from wilting by maintaining the cells in a turgid or expanded condition.
3. The evaporation of water from the leaf is a very efficient cooling agent.
4. It is the medium by means of which the plant food is transferred from the soil to the plant roots.

In all plants there is a continuous movement of water from the roots upwards through the stem and out through the leaves. The amount of water which is utilised in this way varies considerably with such climatic conditions as humidity and temperature. It also varies

with the particular type of plant. It has been estimated that with the cane plant over one million gallons of water is utilised in the production of a 30-ton crop of cane; this is equivalent to between 40 and 50 inches of rain falling on one acre. When it is also realised that some 70 per cent. of a total crop of cane is water it is obvious that a considerable amount of moisture must be freely available in a soil to produce satisfactory crops of cane. Moreover, since only a certain proportion of the total rainfall penetrates the soil, the remainder being lost by run-off, it is apparent that to give satisfactory results a soil must be readily permeable to water in order to capture and store as much of the rainfall as possible.

The soil must also have a satisfactory storage of water-holding capacity. Its capacity to hold water is governed by the amount of organic matter and clay present. For instance, organic matter will hold twice its own weight of water, clay will hold approximately 50 per cent. of its own weight, while the sand fraction will ony hold 10-15 per cent. It is therefore obvious that the conservation of organic matter or humus in the soil is vitally necessary to maintain the water-holding capacity of the soil. It is also clear that sandy soils will have only a low water holding capacity because, in general, they contain low amounts of humus and clay.

It was previously mentioned that all the moisture of the soil was not available for plant growth, and this is an important factor in the selection of soils for cane growing. The following table gives an approximate picture of the amount of water available for plant growth in the more common types of soil:—

Soil Type.	Water Holding Capacity. Acre inches.	Water Available for Plant Growth. Acre inches.
Sandy loam	2½	2
Loam	3½	2¾
Clay loam	5	3¾
Peat	10	7

It will be seen from the above table that peat soils, which contain very high amounts of organic matter, are capable of storing water equivalent to ten inches of rain per acre, seven of which are readily available to the plant. The remaining three inches is held so tightly by the soil that the plant cannot absorb it. Sandy loam soil, which contains only low amounts of clay and organic matter, carries a lower percentage of available water and therefore is much less able to resist drought conditions than the heavier textured soils.

It is therefore essential for a successful crop production that the soil be maintained in a good state of tilth to permit ready entry of rain, thus avoiding as much loss by run-off as possible.

Soil Organic Matter.

The organic matter of a soil is composed of the residues of plant life. When these residues have become very much decomposed, the decomposition product becomes black in colour and is termed "humus." Humus partially dissolves under the influence of rainfall and is carried down and spread throughout the top soil and sub-surface soil. In addition, the undecomposed organic material, i.e. the harder portions

of leaves and stalks, have a mechanical effect on the soil when mixed with it. These portions form small channels by means of which the water is able to more quickly permeate the soil.

In general, the major effects of organic matter are as follows:—

(1) It gives a dark brown or black colour to the soil.

(2) It increases the retentive power of the soil for plant foods, and has a very great effect in the prevention of the washing out of these plant foods during time of heavy rainfall.

(3) It helps the soil to form crumbs or small aggregates, and this leads to an increase in the effective pore space of the soil. This makes the soil much more loose and friable, and overcomes the stickiness and tendency to setting that is often apparent in clayey soils.

(4) The addition of organic matter greatly accentuates the "loaminess" of the soil.

(5) It greatly increases the water-holding capacity of the soil, since, as previously mentioned, organic matter will hold twice its own weight of water.

(6) It greatly increases the activity of the minute organisms that live in the soil. These organisms are fungi and bacteria and they play a very important part in maintaining the fertility of the soils.

For many years it has been well known that the presence of organic matter in a soil is of considerable importance. However, many experiments and observations indicate that the value of organic matter is governed by the *quality* rather than the *quantity* of the material. In this respect it would appear that the most useful types of organic matter are those which contain appreciable amounts of sugar and nitrogen. The presence of both of these substances is particularly important to provide food for the development of the micro-organisms, which are the life of the soil.

As far as the sugar industry is concerned, it is indeed fortunate that the stubble remaining after the crop is harvested supplies a considerable amount of organic matter, which is high in sugar. Furthermore, the application of such by-products as molasses is another factor which helps to maintain the soil life. In this respect, also, the regular growing of green manure crops, the residues of which are high in nitrogen, is a particularly valuable procedure for efficient management of a soil devoted to continuous production of sugar cane.

THE FORMATION OF SOILS.

We have already seen that soil consists for the most part of mineral matter which originates from the decomposition of solid rock. This breaking down or decomposition of the rock is known as *weathering*. A very important type of weathering is physical weathering. This is brought about by temperature conditions for the most part, and also by the influence of moisture from the rainfall. When these temperature changes are of sufficient magnitude there will occur continual expansion and contraction which causes splitting of rocks and the cracking of rock fragments. In colder climates the action of frost is also important since the joints and crevices which are filled with water will freeze and the

subsequent expansion due to the formation of ice causes further cracking. Other agents of physical weathering are running waters in rivers, wave action and the blast of sand grains carried by wind. These are of more or less importance in various localities.

The fine material which is carried in suspension in rivers and streams is deposited in those places where the flow of water lessens. In this way are formed the great areas of soils known as alluvials. Delta formation at the mouths of large rivers is responsible for creating huge tracts of alluvial country and throughout the world there are many notable examples, e.g., the Nile Delta. Here in Queensland we have the vast sugar producing delta of the Burdekin River. In actual fact over one-third of the cultivated areas throughout the world are on alluvial soils.

Another important type of weathering may be termed chemical weathering and under the tropical and sub-tropical conditions which occur in Queensland this is probably more active than physical weathering. Under very moist and warm conditions rain water with its weakly acid properties will attack even the most stable of rock minerals. As might be expected it is particularly destructive on the iron bearing material, causing the iron to rust with the ultimate complete rotting of the rock.

A third type of weathering may be termed *biological weathering* and this is due to the presence of plant and animal life. Plant roots have a very great effect in causing further decomposition of partially decomposed rock material, particularly because they facilitate the penetration of moisture to greater depths.

Soil Profile Development.

In considering soil forming processes, we have so far dealt only with those changes whereby rocks are converted into soil minerals. However, a collection of soil minerals does not constitute a soil any more than a heap of bricks is a house. If we examine the profile of a soil exposed in a cutting it will be noticed that there is a succession of layers underlying each other from the surface down to the solid rock underneath. These layers are sometimes called "horizons." The presence of these horizons is very often clearly marked and the variation in colour and soil texture is very noticeable on a freshly exposed cutting. These horizons are formed by the downward movement of water which dissolves out certain material, particularly that which is rich in iron, and redeposits it at a lower level. The very fine particles such as clay are also carried down and these, too, are redeposited. As this process continues so there occurs the gradual washing down of material from the surface soil and the formation of a heavier layer which we know as the sub-soil. As is well known, most sub-soils contain considerably more clay than the surface soil and this is due to the removal of the fine material from the surface layer and the subsequent concentration at a lower level. The accompanying diagram shows the composition of the various horizons of a soil and it should be noted that the soil and sub-surface soil are generally termed the *A* horizon and the sub-soil is termed the *B* horizon. The third horizon shown in the diagram is the parent rock and this is usually called the *C* horizon.

Because the *A* horizon is the one which supports plant life it is the one which is most important agriculturally. It is generally much darker in colour than the sub-soil because it contains practically all the residues of plants and it is noticeable than it contains more organic matter at the top than towards the bottom.

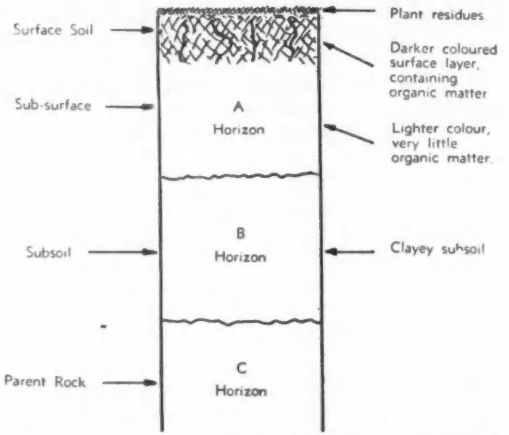


FIG. 50.—Illustrating the various horizons in a soil profile.

PROPERTIES OF SOILS.

The properties of soils may be divided into two categories:—

(*a*) The physical properties.

(*b*) The chemical properties.

In general, the physical properties of the soil are those which govern the moisture relationships and also have a large influence on cultivation practices. The chemical properties are directly related to the plant food content of the soil.

Physical Properties.

Soil Texture.

Soil texture is an important characteristic which may readily be determined in the field. Various terms are used to describe the texture of a soil. The most commonly used terms are: sand, sandy loam, loam, sandy clay loam, clay, clay loam, and sandy clay. Since a soil is a mixture of particles whose sizes range from relatively coarse material (sand) to very fine material (clay), its texture will depend on whether the coarse or fine particles predominate. A sandy soil or sandy loam will contain a high proportion of sand in preference to clay, while a loam or a clay soil is characterised by a much larger proportion of clay. The determination of the texture of a soil or subsoil should always be carried out on a moistened sample. Conclusions made from the examination of a dry soil are often misleading, e.g., unless the sample is wetted, a clay which is slightly granular in appearance may be mistaken for a sandy soil. The following procedure is recommended for determining

texture:—Soil held in one hand is slowly moistened with water and the water is added cautiously until the soil is quite wet, but not sloppy. The soil is then kneaded with the fingers of the other hand. If free water oozes from the soil after it has been well kneaded, too much water has been added. This may be remedied by the addition of a little more soil. The "feel" of the soil is noted during the kneading process. The texture can now be determined since the various textures will impart the following characteristics to the moistened soil:—

Sand.—A soil which may be classified as a sand will be loose and incoherent. It will not stick or bind at any moisture content. If the wet sample is squeezed between the fingers the individual sand grains can be felt, and it will be evident that a large number of them are present. There is no plasticity and the soil cannot be moulded. With a further addition of water the mass will fall apart.

Sandy Loam.—A soil possessing this texture is slightly more coherent when moist than a sand. It shows a very slight degree of plasticity, and, therefore, when it is squeezed in the hand it will mould itself into a lump. However, this is loose and friable and falls apart readily. A large number of sand grains are present. There is no trace of stickiness.

Loam.—In this texture class, the proportions of sand and clay present are such that neither of these two constituents predominantly influences the "feel" of the moist sample. The "loaminess" is readily recognised since the sample does not feel sandy, nor is there any suggestion of stickiness. When the sample is kneaded it becomes definitely plastic and may be moulded into blocks or cubes. These are porous and under slight pressure break readily with the formation of large cracks. The moist soil may be rolled into a rope-like form between the palms of the hands. This is not flexible and breaks with slight bending.

Sandy Clay Loam.—The features which distinguish this texture class from a normal loam are the presence of sand particles, which can be felt in the moist sample, together with a stickiness imparted by an increased clay content. It is most aptly described as a sticky sandy loam.

Clay.—A clay soil will absorb a considerable amount of water. When wet it is noticeably sticky and exhibits a high degree of plasticity. It may be moulded into numerous shapes. Pressure on these moulded forms produces indentations, or a change of shape, rather than a disruption of the mass. It may be rolled into long threads, the ends of which may be joined to form a ring.

Clay Loam.—As the name indicates, a wet soil of this texture will possess a "feel" which is intermediate between that of loam and clay. A loamy tendency is apparent, but a definite stickiness is also noticeable. It is possible to roll it into long threads, the end of which may be joined with little difficulty.

Sandy Clay Loam.—This has a high clay content and therefore possesses almost the same degree of plasticity and stickiness as a clay soil. It contains, however, a noticeable proportion of sand, which can be felt when the moist sample is rubbed between the finger and thumb. Usually, it is composed of sand and clay with only a small proportion of particles whose sizes are intermediate between these two extremes. The organic matter content is generally low, and a sandy clay texture occurs most commonly in subsoils.

Soil Structure.

The term "structure" as applied to the soil is often confused with texture. It is, however, an entirely different property. The texture is seldom apparent to the eye, but is recognised most conveniently by the sense of touch. Structure, however, can be seen, since it is the state reached when the small particles of the soil form visible aggregates Cloddiness is a definite form of structure. Although texture and structure are separate properties, the structure of a soil is often dependent upon its textural characteristics, and certain textures often give rise to characteristic structures. In general, it will be found that the lumps or clods become larger and more compact as the clay content increases.

The soil organic matter also plays an important part in the formation of structure. Its chief function is to reduce the size of the clods by rendering them porous and friable. In this state they readily break down into a loose mass of small soft "crumbs" about one-quarter inch in diameter. Such soil is readily permeable to water, has a high moisture supply power, and is well aerated. It is particularly suitable for sugar cane culture. A "nutty" structure is one in which the aggregates are ½ to 2 inches in diameter. When the soil lumps are 4 to 10 inches wide the structure is termed "cloddy."

In the loams and clay loams, the presence of a favourable soil structure is essential, for its presence means that there is a satisfactory system of passages between the soil aggregates or lumps, thus allowing the free entry of air and the removal of excess moisture. This greatly improves the drainage of the heavier surface soils. Moreover, since the rate of penetration is increased. there is less loss of water by surface run-off. Consequently, not only is erosion decreased, but the replenishment of the moisture content of the sub-surface and subsoil layers is facilitated.

Structural aggregates do not form in the sands and sandy loams. However, water movement is not restricted in these, since the high percentage of sand present maintains a loose and porous condition in the soil.

Soil Colour.

The colour of the soil is one of its most obvious characteristics and it often serves as an indicator for certain conditions which are most important. A dark colour is usually associated with humus since organic matter readily imparts a dark colour to the soil, and therefore in general such soils are usually more fertile. The light coloured soils show lack of lumps and also lack of iron. Since lack of iron usually denotes intensive leaching or washing out of the elements of the soil under conditions of high rainfall it also implies the loss of plant foods and therefore poor productivity.

Bright red colours indicate a fairly high proportion of iron oxide which is in contact with sufficient air to cause rusting of the iron present and therefore this bright red colour denotes that the drainage and aeration of the soil is good. When the colour is predominantly yellow this indicates that the iron compounds are not in contact with sufficient air to form a high degree of rusting and therefore it follows that the soil contains only limited amounts of oxygen and the drainage is very likely to be poor. Very often red and yellow mottling is noticeable in the subsoil and this indicates a zone of fluctuating water table in which alternating conditions of good and bad drainage occur.

Wilting Point.

The wilting point of the soil is a most important characteristic since it indicates the percentage of moisture below which the plant begins to wilt and growth is retarded. For instance, some heavy soils may have a wilting point at approximately 15 per cent. moisture which means that the soil retains this percentage of moisture so tightly that the plant roots are not able to absorb it. Therefore, it is obvious that a knowledge of the wilting point of a particular soil is highly desirable, particularly when new lands are being opened for farming purposes.

Field Capacity.

The field capacity of a soil is a term that again relates to the moisture properties of a soil and it is usually used to denote the amount of water held under conditions of free drainage. The maximum field capacity is usually obtained just after rain when the excess water is drained away and before any loss by evaporation has occurred. The amount of moisture between the field capacity and the wilting point is the maximum amount of water available for plant growth. Therefore, if we can determine the wilting point of a soil and also its field capacity we at once have a measure of the power of that soil to resist droughty periods.

Chemical Properties of Soil.

As has been previously mentioned, the chemical properties of the soil are particularly important since under this heading are included those substances which we know as *plant foods.* These are essential to the growing plant and if they are not present there can be no plant life. The chief plant food substances are nitrogen, phosphoric acid, potash, lime, magnesia, sulphur, oxygen, iron, aluminium and sodium. In addition to these main plant foods there are also such materials as copper, zinc, boron and manganese which must be present for normal growth of the plant. These are usually required in much smaller amounts than the main plant foods and in general most Queensland soils are sufficiently well supplied with these substances.

However, there are very few areas in our sugar producing districts which contain a sufficiency of the main plant foods, i.e., nitrogen, phosphoric acid and potash and therefore it is necessary to supply this deficiency by means of fertilizers. The amount of nitrogen taken up by the plant directly controls the formation of the leaves and to a lesser extent the stem and woody material of the plant. Phosphoric acid is used right throughout the plant, but is generally regarded as being particularly important in the formation of roots. On the other hand potash is essentially concerned with the formation of sugars within the plant and this at once indicates its importance in the production of sugar cane. It should be made quite clear that, if any one of these three elements is missing, or is not present in sufficient amount, the other two cannot carry out their normal functions which are necessary for the growth of the plant. Therefore, with most Queensland sugar cane soils it is usually wise to apply a fertilizer which contains all three of these major plant foods.

FERTILIZERS FOR SUGAR CANE.

Nitrogen.

Because of its role in the formation of the leaves and growing portions of the plant it is obvious that nitrogen is a very important fertilizer for sugar cane production. Furthermore, with very few

exceptions Queensland soils are deficient in nitrogen. This is because of the high rate of loss of humus under our very warm temperatures and high summer rainfall conditions. Nitrogen, therefore, must be applied as a fertilizer unless it has been supplied in the form of a green manure crop. As green manuring has been dealt with elsewhere (Farm Bulletin No. 10) we shall only consider the supply of nitrogen by means of fertilizer.

The main source of nitrogen for sugar cane is sulphate of ammonia. This is a white crystalline substance which possesses the free running and water soluble properties that are particularly suitable for fertilizing sugar cane. A valuable source of present day supplies of sulphate of ammonia is by means of a direct synthetic process in which nitrogen is extracted from the air. A secondary source which is important in Queensland is from nitrogen obtained from the combustion of coal during the process of gas or coke manufacture. Sulphate of ammonia contains about 20 per cent. nitrogen.

A source of nitrogen which is also used in considerable quantities in the sugar industry is that derived from organic material which is a by-product of meatworks and is usually termed blood and bone. This is a particularly effective source of supply, but, unlike sulphate of ammonia, is not water soluble. Therefore, it must be intimately mixed with the soil so that it may be acted upon by the minute soil organisms before the nitrogen is released and becomes available to the plant. Sulphate of ammonia, of course, being soluble in water is immediately available for uptake by the plant as soon as it is dissolved in the soil moisture. For this reason blood and bone is used as a source of nitrogen for planting or ratooning mixtures, where it is placed in a drill and mixed with the soil. Sulphate of ammonia is mostly used as a top dressing, since it can be scattered on the surface of the soil, where it is readily dissolved and carried down by rain water.

Another source of nitrogen is *sodium nitrate*. This substance is also readily soluble in water and therefore can be used in place of sulphate of ammonia as a top dressing. However, it possesses a serious disadvantage in that it absorbs moisture from the atmosphere and on drying out will set very hard and cake readily. This is a very bad feature, particularly when it is included in fertilizer mixtures that must be applied by means of a fertilizer distributor. For this reason sodium nitrate is usually avoided for sugar cane since our sugar producing areas normally have very humid climates. In colder countries sodium nitrate is equally useful as sulphate of ammonia. It contains approximately 16 per cent. nitrogen and therefore under normal conditions is sold at a lower rate per ton than sulphate of ammonia.

A suitable rate for top dressing sugar cane which has not been green manured prior to planting varies from 1-2 bags (160 lb. per bag) of sulphate of ammonia per acre. This is usually given when the plant cane is well stooled and two light applications are more efficient than one heavy one. The first application to ratoons is usually made when the cane is 12-18 inches high, with a subsequent dressing about four weeks later, depending on the nature of the weather.

Phosphoric Acid.

The main material for supplying phosphoric acid is *superphosphate*. Superphosphate is artificially produced by the action of sulphuric acid on phosphate rock. The acid treatment results in the phosphate content

of the rock being converted to a water soluble form and it thence becomes readily available to the plant. Another valuable source of phosphoric acid is finely ground bone dust or a mixture of blood and bone. However, these latter two sources are not water soluble as is the case with superphosphate and, therefore, must be intimately mixed with the soil to allow decomposition before the phosphoric acid becomes available to the plant. This takes a certain length of time and most fertilizer mixtures usually contain some of the phosphoric acid as superphosphate to maintain the plant until the plant food from the bone dust has become available. With sugar cane production, materials containing the phosphoric acid necessary for the growth of the plant are always provided by means of the planting or ratooning mixture. These are placed in the drill and are not used as a top dressing. A large proportion of Queensland sugar cane soils are deficient in phosphoric acid but others such as the red basaltic loams and Burdekin delta alluvials are well supplied with this plant food and consequently in such soils very light dressings only are necessary.

Potash.

Because this element plays an important role in the manufacture of sugar within the plant it is obvious that sugar cane must have access to ample supplies of potash. Fortunately, most Queensland soils were not particularly deficient in potash under virgin conditions, but, nevertheless, with continued cultivation the soil supplies have become seriously exhausted and have fallen below the requirements of a well-grown crop of cane. In this respect it may be noted that a 20-ton crop of cane will remove approximately 1½ cwt. of muriate of potash from the soil. In most districts it is now necessary to use mixtures containing a certain amount of potash for both plant and ratoon cane. It is usually present in these mixtures as *muriate of potash* and this material is very suitable for inclusion in drill fertilizers. By itself, muriate of potash has a tendency to take up moisture and set hard; however, it looses this tendency when combined with the meatworks manures which are also contained in the mixture.

Mixed Fertilizers.

As has been previously mentioned, it is a wise plan to include all three plant foods—*i.e.*, nitrogen, phosphoric acid, and potash—in the fertilizers which are applied to sugar cane. However, as might be expected there is a considerable variation in the amount of these plant foods, which are supplied by the particular soil types themselves; for instance, some alluvial soils may contain very high amounts of available potash but very low amounts of phosphate. On the other hand, it is a well known fact that red volcanic soils are well supplied with phosphate but not with potash. Therefore, it is obvious that it would be wasteful to apply the same type of fertilizer to both these kinds of soil. Consequently, as a result of a large number of experiments on various kinds of soils, the Sugar Bureau recommends the use of three different types of fertilizer throughout the sugar areas.

In the first place it should be noted that all Queensland soils, with very few exceptions, contain low amounts of nitrogen and consequently it is generally necessary to apply an adequate amount of this element to all the many and varied soils extending from Mossman to the Logan. It, therefore, remains only to vary the amounts of phosphate and potash in order to provide a selection which will satisfy the requirements of the soil types containing different amounts of phosphate and potash.

In order to do this, three mixtures have been standardised by the Bureau and are termed "Sugar Bureau Mixtures," and these are now put up by all the leading fertilizer companies. They are as follows:—

Sugar Bureau Mixture No. 1.—Rich in phosphate and poor in potash;

Sugar Bureau Mixture No. 2.—Moderate amounts of both phosphate and potash;

Sugar Bureau Mixture No. 3.—Poor in phosphate and rich in potash.

Mixtures Nos. 1 and 3 are used only when one of the two plant foods in question is deficient and the other is in fairly good supply. Mixture No. 2 is used when both are present in poor amounts and, conversely, it is also used for soils which contain good amounts of both plant foods. This latter course is recommended in the form of light dressings in order to ensure that a soil which is initially well supplied with phosphate and potash does not become seriously depleted in these essential elements with continued cultivation.

Since nitrogen is not required in great amounts in the very early stages of the plant's life, the nitrogen content of each of the planting mixtures is kept low. This is also necessary in order to avoid damaging the eyes and the young shoots and roots, which are very readily injured by sulphate of ammonia. Therefore, the bulk of the nitrogen required for producing the crop is applied later as a side dressing when the plants are well established and are much more capable of using it efficiently. However, since the old stools have a certain number of established roots, ratoon cane can utilise more nitrogen at an earlier stage than plant cane. Therefore, the three Sugar Bureau mixtures are slightly modified for application to ratoon crops by increasing the amount of nitrogen present. Consequently, it should be noted that these recommended sugar cane fertilizers are available for either plant or ratoon cane and the grower should be careful to specify whether he requires a planting or ratooning mixture when making his purchase. Since ratoon cane does not have the advantage of either a fallow period or a green manure crop to allow the build up of nitrogen in the soil (as is the case with plant cane) it has been found that for ratoon crops a heavier top dressing of sulphate of ammonia is also a definite advantage.

The amounts of mixed fertilizer placed in the drill at planting or ratooning varies according to the soil requirement—*e.g.*, a soil that is very low in available plant foods requires a heavier fertilizer dressing than one which is well supplied. As the result of a large number of soil analyses and fertilizer field trials the Bureau has been able to define the fertilizer requirements of the soil types of most districts, and recommendations as to fertilizer are made very often on a recognition of the soil type. However, there are many cases in which a soil analysis is required to assess the amounts and type of fertilizer required, and in order to do this the Bureau maintains a soil-testing service which may be availed of free of charge by cane growers.

Lime and Magnesia.

Many sugar growers are well aware of the beneficial effect obtained where materials containing lime or magnesia have been applied to certain types of soil. Some confusion exists, however, as to what actually happens when lime or dolomite (which is lime plus a certain amount

of magnesia) is mixed with the soil and why this improvement occurs on some soil types and not on others. The effects produced by either of these two substances may be briefly summarised as follows:—

(*a*) The correction of excessive soil acidity by neutralising soil acids;

(*b*) Altering the physical nature of the soil and producing a mellow, more friable condition;

(*c*) Providing lime and magnesia for use as plant food, since these two substances themselves are essential for plant growth.

Fortunately, sugar cane is rather tolerant as far as soil acidity is concerned, and may be grown successfully even on soils which are too strongly acid for many other crops. However, continuous cultivation, particularly under irrigation, accelerates the loss of such acid correcting substances as lime and magnesia. Furthermore, the use of acidic fertilizers such as sulphate of ammonia also tends to increase acidity and after several years continuous use soil acidity may be built up to a degree which prevents the optimum growth of the plant. Such a condition may be quickly and satisfactorily corrected by an application of lime or dolomite.

A high degree of acidity is particularly unfavourable for the growth of most green manure crops. It is also injurious to the minute soil organisms whose presence is essential for the conversion into humus of the ploughed-in residues of these plants. The presence of a high concentration of soil acids will prohibit the rotting of vegetable matter to such an extent that the value of green manure may be reduced to almost negligible proportions. Therefore, an occasional dressing of lime or dolomite in conjunction with a green manuring programme will considerably assist in maintaining the humus content of continuously cultivated soils. With the exception of the very sandy types, soils which are deficient in humus are usually difficult to prepare and bring to the good tilth necessary for planting.

In addition to their beneficial effects on the tilth of the soil by creating conditions favourable for the manufacture of humus, lime and dolomite also have a direct chemical effect on the clay particles which are present in all soils. These minute particles which occur in considerable proportion in the heavier soils become aggregates, i.e., large numbers of them join together forming small lumps or crumbs. When in this condition, the soil does not set or form large clods, and the drainage is considerably improved. Soils which are "sour," i.e., those of low lying areas which remain wet and practically waterlogged for long periods, have often been reclaimed by heavy dressing of lime or dolomite, providing a system of artificial drainage is put in at the same time. This drainage, of course, is necessary to carry away the water which will be freed from the soil as a result of the improvement in physical condition. Unlike an analysis for soil acidity there is, unfortunately, no chemical test which will indicate the necessity for lime as far as soil tilth is concerned. If a soil is not highly acid but is cloddy and difficult to work, a dressing of lime or dolomite will often create an appreciable improvement, particularly if green manuring is carried out in rotation with cane growing.

Lime and magnesia, as well as being soil improvers, are also, in themselves, important plant foods, and herein lies the only essential difference in the use of lime and dolomite. If a soil is deficient in

magnesia, dolomite must be used since it alone contains magnesia. On the other hand, should the soil be deficient in lime, then either lime *or* dolomite could be used, since the latter contains both lime and magnesia, usually in about equal amounts. Fortunately, however, practically all Queensland soils which are suitable for sugar growing contain sufficient amounts of magnesia to supply the plant's requirements, even after being cropped for a large number of years. The amount of magnesia taken up by the plant is small in relation to the actual amounts present in most soils. In general, then, the application of lime or dolomite is mainly necessary to correct soil acidity and to improve the physical condition. Since either of these materials is equally effective in these respects the question of which to use is simply a matter of which is most easily procurable, having due regard to their cost and purity.

Lime may be purchased in several forms, all of which are suitable for agricultural purposes. Dolomite is available in one form only. The various commercial lines are as follows:—

(*a*) Agricultural lime (carbonate of lime);
(*b*) Dolomite (carbonate of lime plus carbonate of magnesia);
(*c*) Burnt or quick lime (oxide of lime);
(*d*) Slaked lime (mixture of hydrated oxide and carbonate of lime).

The power of these substances to neutralise acidity is termed the "*neutralising value.*" In order to create a standard for comparison purposes, the neutralising value of one hundred per cent. pure agricultural lime, i.e., carbonate of lime, is taken as 100. If it contains impurities, the value will be less and in order to indicate this fact to the grower the neutralising value is printed on the label attached to the bag. Supposing, for instance, a grower was able to obtain two samples of agricultural lime at the same price, one of which had a neturalising value of 90 and the other of 80, the former would be preferable, since it would take 9 tons of the latter to have the same effect as 8 tons of the higher grade lime. This same system of evaluation may be applied to dolomite. Burnt or quick lime has a higher value than agricultural lime, whilst slaked lime is also higher, but slightly less than burnt lime. On ton of burnt lime with a neutralising value of 160 would be equivalent to 2 tons of agricultural lime or dolomite, with a value of 80. Therefore, if a grower has the choice of several sources of lime, or dolomite, a consideration of the neutralising value stated on the label, in conjunction with the price, will enable him to make the most economic purchase.

A further point to be considered in the purchase of lime or dolomite is its degree of fineness. Since these substances do not dissolve in water, it is necessary for them to be in a very fine powdery state for the maximum reaction to occur when mixed with the soil, and moreover, the speed at which this takes place is practically entirely dependent upon the fineness. Because the process of burning lime results in a very finely grained product, burnt lime has a much more rapid action than agricultural lime or dolomite. Since slaked lime is simply burnt lime which has been exposed to the air, it is also very powdery and quick-acting. In general, however, agricultural lime and dolomite are ground to a satisfactory state of fineness before being placed on the market, since it is required by law that the degree of fineness be declared on the label. As a general approximation, it may be stated that burnt or slaked lime will be effective in about a month after application, while a good agricultural lime or dolomite will require from two to three months.

The Quest for Early Maturity.

By J. H. BUZACOTT.

FOR the past ten or twelve years the production of new varieties has centred largely on canes with a good cropping capacity and which have reasonably good sugar from mid-season onwards, with a result that most of the modern varieties produce a high yield of sugar per acre but their sugar content is rather low early in the season. The elimination of such early maturing varieties as H.Q.426, B.208 and S.J.2 from many of the mill areas on account of disease susceptibility has latterly rendered the problem of canes for early harvest more acute. In addition the demand for early maturity is accentuated by the fact that shorter working hours necessarily prolong the crushing period of mills. In consequence, particularly in North Queensland, most mills desire to commence crushing operations rather earlier in the year in order that their crushing should be completed before Christmas. If extended beyond Christmas wet weather is liable to cause hold-ups in the harvest and furthermore it is often difficult to hold satisfactory labour over the Christmas holidays.

This position has been realised by the cane breeders for a number of years and some considerable efforts have been made to overcome it by an adjustment of the cane-breeding programme to the production of early maturing varieties. So far this work has not been marked by a high degree of success. The number of early maturing varieties produced has been few and these have all been eliminated in trials either due to disease susceptibility or poor agricultural characteristics. The main reasons for this lack of success appear to be firstly the lack of early maturing varieties for use as parents. Although in our parental stocks we have some 25 varieties which are early maturing, only eight of these produce sufficient viable pollen to be of value as males in cane breeding. In addition some of these varieties flower very rarely so that there has been considerable restriction placed on the number of combinations possible if early maturing parents are used on both sides of a cross. Secondly there is the necessity for introducing wild blood into modern crosses to ensure resistance to harsh conditions. For commercial purposes it is usually necessary to bring the proportion of wild blood in a variety down to one-eighth or less, so that to breed in this strain of wild blood with the necessary dilution takes some years.

Partly due to the lack of sufficient early maturing canes which produce viable pollen and partly due to the desire to introduce wild blood, most crosses made in the past for the purpose of attempting to produce early maturity consisted of using only one early maturing parent, whilst the other parent was chosen for vigour or disease resistance. The use of crosses which are known to give progeny with high sugar has been rigorously exploited and, in particular, three crosses were heavily worked for many years. These three combinations are Oramboo x H.Q.409, Badila x S.W.499 and Q.27 x Badila. These combinations all produced a number of early maturing varieties many of which just failed to reach commercial standards. The principal factors in their failure were poor ratooning powers and disease susceptibility, whilst in the case of Badila x S.W.499 lack of vigour was a bad feature.

As regards the future the outlook is distinctly more hopeful. The high sugar parents with most promise at the present time are the

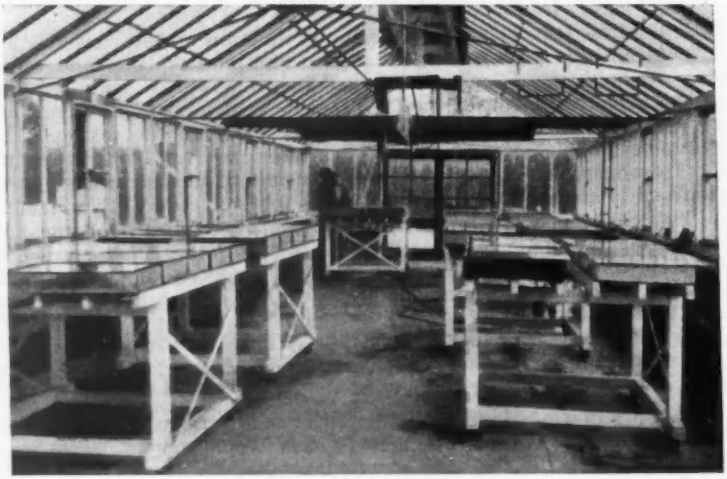


FIG. 51.—Some of the 1949 seedlings being germinated in flat trays in the glasshouse at Meringa Station.

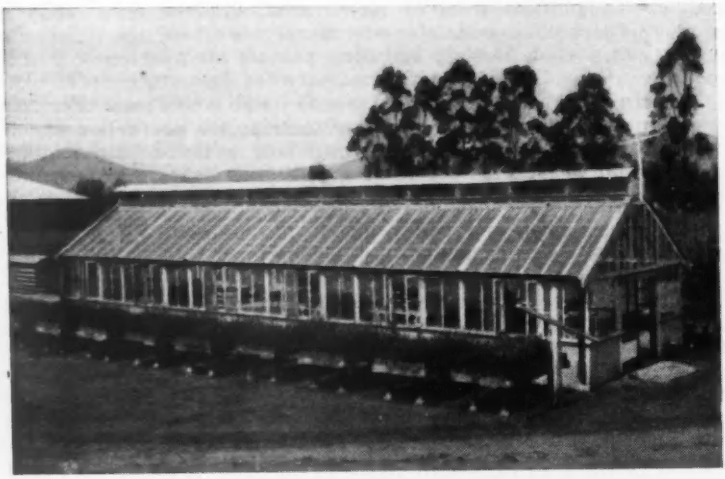


FIG. 52.—After germination in the glasshouse the seedlings are transplanted into pots and placed outside the glasshouse to make further growth before being set out into the field.

varieties Atlas, Co.281, Comus, D.285, Eros, Korpi, Oramboo and Q.13 since these varieties have in the past produced canes with a good sugar content even when combined with parents which have a sugar content no better than average. It has generally been regarded that the incorporation of wild blood in a cross of necessity conferred late maturity on the progeny. Although this is usually the case certain varieties have recently demonstrated that they are capable of producing early maturing progeny with as much as one-quarter wild blood, and these varieties have given new hope for a combination of early maturity and vigour. For instance, Korpi and Q.13 have recently mothered early maturers when crossed with the half-robustum varieties C.278 and C.279. Consequently great hopes are felt for these two varieties as parent canes for early maturity now that at least some early maturing wild-blooded varieties are available with which to mate the early maturing noble canes.

Certainly it is not necessary for the future early maturers to have wild blood but the resistance to harsh conditions created by the inclusion of wild blood is a very desirable characteristic, and since it is possible to produce early maturing canes with a percentage of wild blood it is considered that such canes would be of much greater value to the industry.

From these considerations it can reasonably be stated that the future production of early maturing varieties has far greater possibilities than ever before. Whilst formerly the crossing of two early maturing varieties was limited to comparatively few combinations a number of canes produced during recent years have early maturing characteristics which may render them useful as parent canes. Two of the "G" series both of which are one-quarter *robustum* blood, G.262 (Korpi x C.279) and G. 323 (Q.13 x C.278) have shown high early sugar and although the former has not flowered to date the latter has already been used in crosses. In the "H" series, H.231 (S.J.4 x A.285), H. 233 (Q.44 x Oramboo), H. 254 and H.281 (Q.44 x P.O.J. 2940) show signs of early maturity and with the exception of H.233 these bear either *spontaneum* or *robustum* blood.

A critical examination of the possible combinations of two early maturing canes, having due regard to the pollen-producing and flowering habits of the varieties, shows that there is a large number of combinations yet to be tried. Disappointments will undoubtedly occur. Some of the new crosses will produce inferior types of progeny whilst others will fail due to sterility or incompatibility. During the 1949 cross pollination season, for instance, no less than 13 different crosses with Pindar and five with S.J.2 were made. Not one seed germinated from these eighteen crosses. S.J.2 rarely flowers and the arrows used were brought from the Burdekin district. Pindar on the other hand arrows freely under some circumstances and it will be given a further trial as a parent using arrows from other sources. Nevertheless by virtue of the fact that a far greater selection of early maturing parents is available than ever before the prospects are bright and there should be a reasonable chance to discover at least a few early-sugar-producing crosses to supplement the two or three which we are already using. Of these latter the three most promising which have come to the fore during the last year or so are Trojan x Eros, D.285 x Comus and Co.270 x P.O.J.2878. Brix tests during selection indicate that these three crosses have quite a reasonable number of progeny which give a high early brix.

The Casewell Compaction Roller.

By J. T. ELLIOTT.

THE drought conditions which prevailed throughout the Mackay-Proserpine district during the 1946 season witnessed a desperate effort by all growers in an attempt to conserve their meagre soil moisture, both in the preparation of their seed beds and after planting.

Growers were compelled to adapt their cultivation methods to the governing moisture conditions and the old practice of consolidating the soil on the planted sett in the furrow in times of low moisture became almost a general farm practice during the 1946 planting season. Although the resultant aim was moisture conservation by compaction, the methods of appliance varied considerably from dragging a light log in the furrow behind the planter to running the pneumatic tyres of a light tractor in the furrow.

Numerous light homemade rollers appeared and these were usually attached by chain to the planter and the consolidation was dependant on the weight of the roller. This detached type created a nuisance value when turning or backing, &c.

An outstanding roller seen in operation in the Proserpine area was invented by J. R. Casewell, Glenisla. An application for a provisional patent has been made by the inventor.

The Casewell roller, shown in the accompanying photographs, is simple and light in construction and is a permanent attachment to the cutter planter. The pressure for compaction is provided by two spiral springs and is readily adjusted by shortening or lengthening

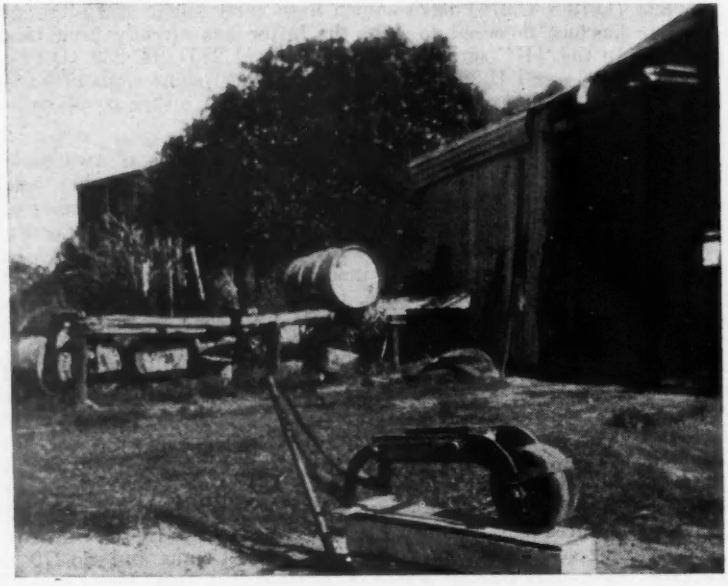


FIG. 53.—The roller detached from the planter.

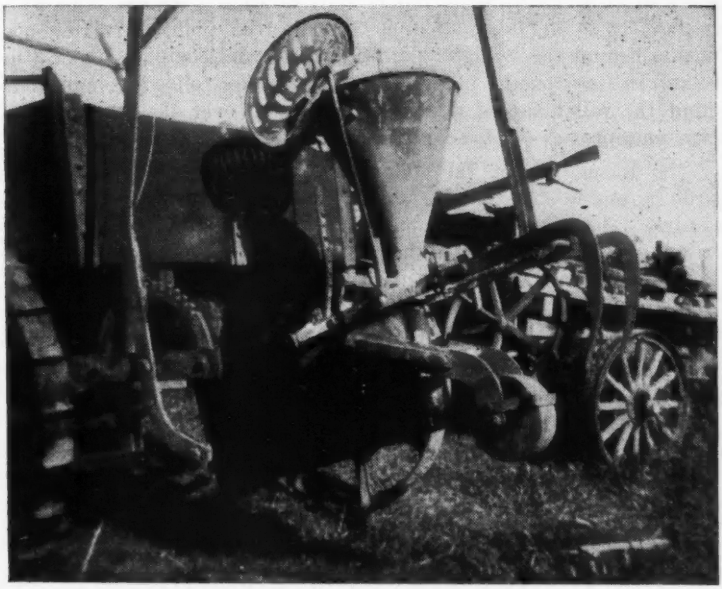


FIG. 54.—Showing the roller in the raised position for turning on headlands.

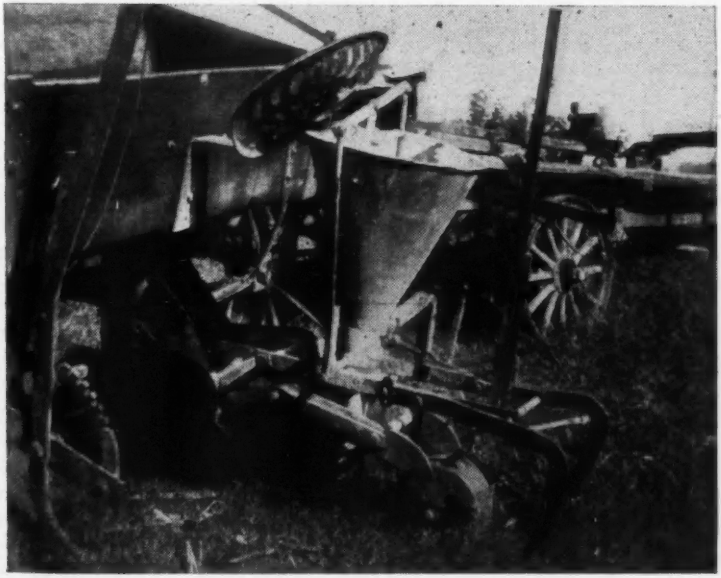


FIG. 55.—The roller in the working position. Note the tynes which give a cover of loose soil on the compacted layer.

the chain attachment. The roller, built by joining two scuffler wheels together, is so arranged that it runs in the planted furrow about 9 inches behind the straight planting boards and compacts the 2-3 inch of "run in" soil on the planted sett. The rakes following immediately behind the roller spread a layer of loose soil over the compacted soil cover, and provides a loose surface mulch.

The framework of the roller is attached loosely to the straight boards by one bolt so that the spring tension can regulate the required pressure. The chain attachment passes around the top of the drill portion of the planter and the spiral springs are protected by the planter-mouldboards as shown in Fig 55.

Once adjusted the pressure remains constant even when crossing drains, depressions, &c., and the whole attachment does not add greatly to the weight of the planter so as to affect the ordinary lifting of the planter when turning on headlands or travelling. The roller performed exceptionally well on soil types varying from sandy to heavy clay loams and no doubt will find popularity with growers when future weather conditions again demand the strict conservation of all soil moisture.

LEAF SCALD DISEASE IN SOUTH QUEENSLAND.

Investigation into a complaint concerning disease in some fodder cane on a dairy farm at Nerang, South Queensland, showed that the death of stools was due to leaf-scald disease. This occurs in many mill areas in the far north but has not been seen in South Queensland for some years. It has occurred in northern New South Wales, but it is not widespread there at present. Its persistence in a planting of cow cane is rather disturbing although not surprising in view of the fact that fodder canes in non-sugar producing areas do not come under the Sugar Experiment Stations Acts and are not under the direct supervision of the Bureau's pathologists. In this instance, farmers in the nearest mill area, that of Rocky Point, need not be unduly alarmed since the varieties grown commercially there are fairly resistant to the disease but any cane farmer who also grows cane as fodder should not get plants from the Nerang area. He should in any case first contact the Bureau before getting any plants outside the area.

—C.G.H.

Mechanical Harvesting of Cane in the Bundaberg District.

By H. G. KNUST.

MECHANICAL harvesting of cane has evidently been receiving the consideration of canegrowers in the Bundaberg district for a good number of years as is evidenced by the fact that Mr. C. Nicolson, of Sharon, made and used a shear blade, horse-drawn cutter during the 1929 harvesting season. Shear blade cutting of cane has increased particularly during the present season, and there would be some 30 to 40 machines in use at present.

In addition the Fairymead single row and two-row cane harvesters and the Toft cane harvester are also used. The Fairymead two-row harvester cuts, tops and bundles about 30,000 tons of cane per year while the Toft and Fairymead single row harvesters harvest a limited tonnage only.

The Fairymead Two-Row Cane Harvester.

This two-row machine (Figs. 56 and 57) has been slightly modified since it was described by Behne (1). The frame on which the power unit, a Farmall Model MD tractor, is mounted has been raised to about two feet above the rear wheels so that the driving seat is well above wheel height, and the rear hinged portion of the gathering, topping and conveying unit has been correspondingly raised. The jack shaft drive has been eliminated and the differential is used for the chain and sprocket drive. The radial fingers and baffle plates previously used

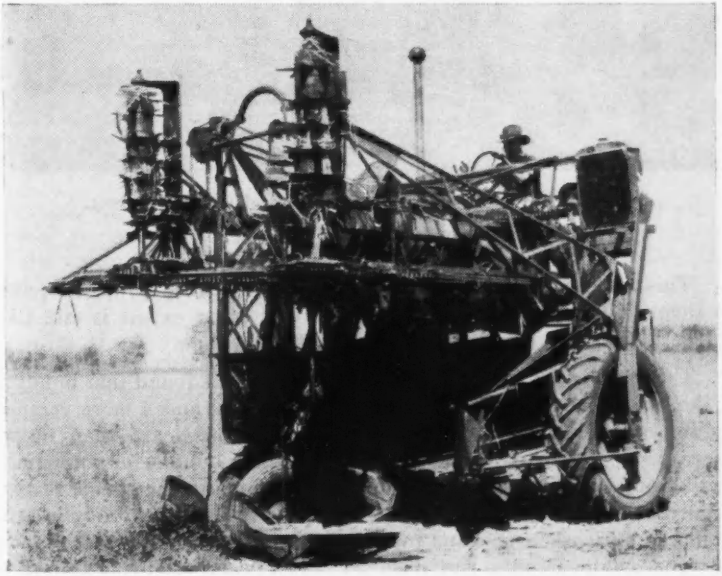


FIG. 56.—The 2-row Fairymead harvester mounted on a Farmall MD tractor.

for the disposal of tops have been discarded and replaced by a number of radial knives which cut the tops into small pieces and throw them clear of the bundles. The radiator has been moved from the front of the machine to above the left rear wheel.

This machine is capable of cutting from 300 tons to 500 tons daily depending on field irregularities, etc. Transverse irrigation drains cause a reduction in tonnage harvested because of the necessity to reduce speed when crossing them. Ideal crops for the machine are those which range from twenty to forty tons per acre.

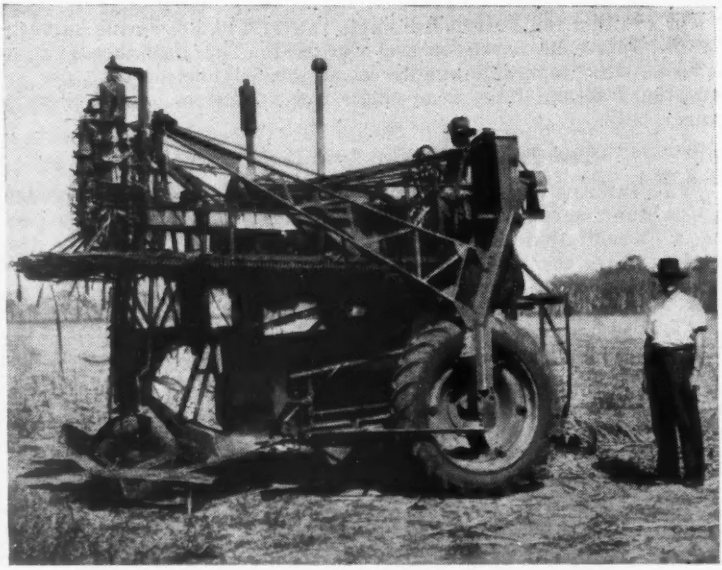


FIG. 57.—Another view of the Fairymead 2-row harvester.

The Toft Cane Harvester.

This machine (Fig. 58) has not been altered since it was described by Behne (1) and although not used to any great extent is still used by the Messrs. Toft for cutting much of their cane.

The topping device is not now used because it is found that bundling of the cane is much simpler with the top attached and a more compact bundle can be dropped from the hopper. Bundles are then topped where dropped. This method provides a better bundle for mechanical loading and is no more costly than machine topping the cane. Labour usually employed for gathering the stalks which inevitably scatter about the field, when machine topping is practised, is employed topping the cane as the bundles are dropped. The neater and more compact bundle decreases the time required for mechanical loading of the cane.

FIG. 58.—The Toft cane harvester.

Shear Blade Cutting.

Shear blade cutting of cane is gaining popularity among the smaller growers of the district. The first attempt at this method was apparently made by Mr. C. Nicolson in 1929. His machine consisted of a beam twenty feet to thirty feet long of eight inch by four inch hardwood to which was attached a shear blade, being a section of a saw blade, set at an angle of about 45 degrees to the beam and a plough seat for the driver. The outfit was drawn by one horse which hauled it between the rows of cane. The length of beam pressing on the base of the stools adjoining the row being cut kept the shear blade in position, prevented the machine pivoting and provided ample opposition to the pressure set up by the shear blade. A fender or gathering arm set at an appropriate height pushed the cane clear after it was cut.

The Norgrove Cutter.

This cutting machine (Figs. 59 and 60) consists of a main frame of braced angle iron pivoted from the final drive housing, drawbar or front of the tractor depending on the type of tractor used. The shear blade base is welded to the front end of the main frame.

Lift.

The frame and cutting blade is lifted and lowered with a lever or with the automatic lift.

Cutting.

The cutting device is a shear blade approximately three feet long and about eight inches wide set at 45 degrees to the longitudinal axis of the tractor. The blade is a heavy steel plate to which is bolted a section of heavy saw steel. A small wheel just forward of the shear blade controls the height of cutting, adjustments being made on a quadrant at the front end of the shear blade base.

Guard Board.

A guard board about nine inches high is fitted to the rear edge of the shear blade base for the purpose of holding the butts of the severed cane and pushing it clear of the tractor.

FIGS. 59 and 60.—The Norgrove shear-blade cutter.

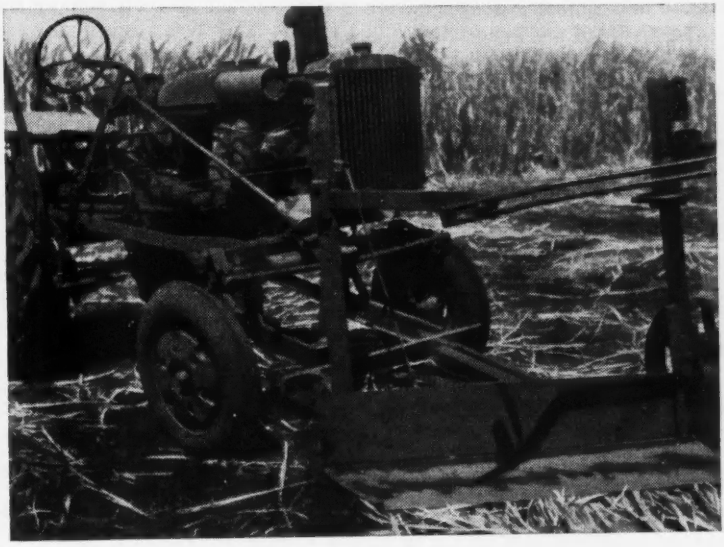
Fender or Gathering Arm.

The adjustable fender or gathering arm is set at an angle of about 30 degrees to the longitudinal axis of the tractor and slightly ahead of the shear blade. This position enables it to apply slight pressure to the stalks before they are severed by the shear blade and causes them to fall at right angles to the cane row.

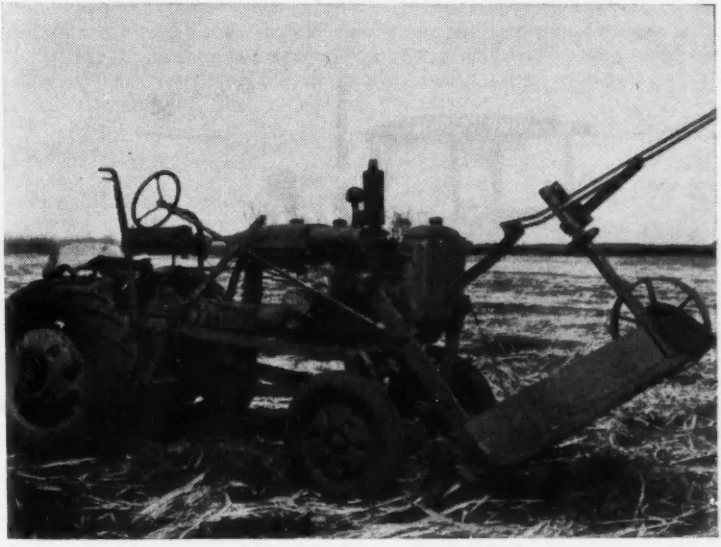
This machine has been fitted to many types of wheel tractors and some crawler type tractors. The cost ranges from £25 to £30 according to the type of tractor and fittings needed.

The Bonel Cutter.

This machine (Figs. 61 and 62) consists of a rigid angle iron frame the rear end of which is attached to the final drive housing, hung from



FIGS. 61 and 62.—The Bonel shear-blade cutter.



brackets fitted to the implement bracket attached to the steering housing and extended below and about two feet in front of the front axle. The shear blade frame is hinged to a plate welded on the front end of the main frame.

Lift.

The blade frame is lifted and lowered with a lever or with automatic lift.

Cutting.

The cutting device is a shear blade approximately three feet long and about eight inches wide set at 45 degrees to the longitudinal axis of the tractor. The blade is a heavy steel plate to which is bolted a section of heavy saw steel. A small wheel fitted to a standard at the front end of the shear blade controls the height of cutting, adjustments being made by means of a screw and castor wheel.

Guard Board.

A guard board about nine inches high is fitted to the rear edge of the shear blade for the purpose of holding the butts of the severed cane and pushing it clear of the tractor.

Fender or Gathering Arm.

The adjustable fender or gathering arm is set at an angle of about 30 degrees to the longitudinal axis of the tractor and slightly ahead of the shear blade.

The machine has only been fitted to wheel type tractors and costs about £50.

FIG. 63.—Another type of Norgrove cutter.

A cutter (Fig. 63) designed by Mr. W. Norgrove and at present working on the farm of B. W. Nicolson and Company, Sharon, is simple yet extremely sturdy. The main frame consists of two pieces of four inch by one inch steel welded to a cross piece of six inch channel iron; the four inch steel members are bolted to the tractor chassis. The plate on which the shear blade frame is hinged is bolted, slightly off centre, to the six inch channel iron which is slotted near the end. A second bolt passes through the slot and plate and by slackening this bolt the shear blade can be tilted at an angle of about 10 degrees to the horizontal plane.

Air Duct.

A galvanised iron air duct is fitted over the radiator and the air enters from the left hand side, away from the cane being cut.

Lift.

The shear blade and frame are ilfted by an improvised lift constructed from a motor vehicle steering gear assembly set on a frame above the tractor. A chain connects the Pitman arm with shear blade frame.

Cutting.

The cutting device is a shear blade approximately four feet six inches long and about eight inches wide set at 40 degrees to the longitudinal axis of the tractor. The blade is a wedge shaped steel plate to which is bolted a section of heavy saw steel. A small wheel fitted to double bracket at the front end of the shear blade base can be adjusted to control cutting height.

Guard Board.

A guard board about six inches high at the front tapering to about three inches at the rear is fitted on top of the blade at an angle of about 30 degrees to the tractor for the purpose of holding the butts of the severed cane and pushing it clear of the tractor.

Fender or Gathering Arm.

The adjustable fender or gathering arm is set at an angle of about 30 degrees to the longitudinal axis of the tractor and slightly ahead of the shear blade.

The estimated cost of the machine fitted to the Model T 20 tractor is £25.

The cutting method generally practised is to traverse one row, cutting and dropping the cane as shown in Fig. 64, gather the cane in bundles clear of where cane from the next row will fall when cut, and proceed to cut the next row until all the cane needed for that day is cut and bundled; then top all cane on the ground. Reasonably efficient cutting can be achieved by any intelligent operator who devotes a little time to shear blade setting and gathering arm adjustments to suit the varietal and soil conditions of the field in which he is working.

FIG. 64.—Illustrating the manner in which the cane is left by the shear-blade cutters.

The farmer-operator unable to secure labour for cutting cane can cut, top and prepare for loading 2 tons of cane per hour, and where a daily delivery of up to six tons of cane to the mill is made is able to harvest his own cane and attend to farm work.

Shear blade frames can be attached and removed with a minimum of lost time and as a consequence the tractor is not immobilised for other farm work.

Working speeds vary from three miles to five miles per hour in crops ranging from eighteen tons to forty tons per acre and best work is done within this crop range. It is advantageous to work with the prevailing wind when cutting erect cane and/or against the bend in slightly recumbent cane.

Although it is considered that shear blade cutting is not responsible for a reduction in cutting costs the work is less arduous and can be performed by labour unable to cut cane manually. In addition the class of cane delivered to the mill is equally as well cut and cleaned as manually harvested cane.

REFERENCE.

(1) Behne, E. R., 1946. Description of Queensland Cane Harvesting Machines. *Cane Growers' Quarterly Bulletin*, October, 1946, p. 98.

Varietal Trials—1949 Season.

By NORMAN J. KING.

THE normal field programme of the Bureau of Sugar Experiment Stations was carried out during the past year and the results of some of the field varietal trials harvested are given below. Owing to the extended nature of the 1949 harvesting season a good proportion of the experiments were necessarily harvested too late for inclusion in this Bulletin, but these will be reviewed in the April number.

The thanks and appreciation of the Bureau are due to the many growers who co-operated in this most important phase of our work. Without such assistance it would be quite impracticable for our field staff to assess the relative values of new varieties; since conditions on the Experiment Stations are suitable only for assessment of values in particular, limited environments and space would not permit of all the work required.

It is a matter for some concern however that in the far northern areas growers, on the whole, are not so interested in having such trials on their farms. In the central and southern districts farmers are considerably more interested in varietal improvement and there is little doubt that these districts have benefited very greatly in recent years as a result of the field varietal trial programme. Varietal trials on farmers' own properties are the only practical means of measuring the performance of new canes against the old and a greater measure of co-operation is urged so that the goal of greater production with higher sugar content may be achieved.

The sugar belt, as a whole, experienced a good year. All districts had better than average seasons although the central district rainfall was subnormal. Despite this—or perhaps because of it—Mackay mills are crushing record crops. Under the conditions which obtained in all areas it may be stated that varietal performance, as indicated by the following trial results, was an indication of their potentialities in a good season.

Dispersed Varietal Trial on farms of A. Thornhill, A. Lizzio, I. Panozzo, E. O'Sullivan, F. J. McNamara, De Roma Bros., and S. J. Dallachy.

A. Thornhill, El Arish.

Soil Type.—Buff alluvial loam. **Nature of Crop.**—First ratoon.
Age of Crop.—10 months. **Harvested.**—July, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	27·62	14·08
Eros	28·69	16·15
Q.54	22·23	15·54

A. Lizzio, Mena Creek.

Soil Type.—Red volcanic loam.
Age of Crop.—12 months.
Nature of Crop.—First ratoon.
Harvested.—September, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	34·02	15 30
Eros	38·45	14·65
Q.54	25·16	16·20

I. Panozzo, Mena Creek Road.

Soil Type.—Red volcanic loam.
Age of Crop.—12 months.
Nature of Crop.—First ratoon.
Harvested.—August, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	28·64	14·70
Eros	28·34	15·50
Q.54	23·22	15·60

E. O'Sullivan, South Johnstone.

Soil Type.—Red volcanic loam.
Age of Crop.—14 months.
Nature of Crop.—First ratoon.
Harvested.—August, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	29·89	15·70
Eros	30·26	14·90
Q.54	20·50	16·00

F. J. McNamara, Mourilyan.

Soil Type.—Red-brown schist.
Age of Crop.—12 months.
Nature of Crop.—First ratoon.
Harvested.—September, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	30·47	14·99
Eros	31·92	12·98
Q.54	22·08	15·20

De Roma Bros. (previously P. Garrone), Mourilyan.

Soil Type.—Red-brown schist.
Age of Crop.—10 months.
Nature of Crop.—First ratoon.
Harvested.—July, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	23·69	13·77
Eros	21·64	15·68
Q.54	16·73	14·80

S. J. Dallachy, Lower Tully.

Soil Type.—Grey-brown alluvial.
Age of Crop.—13½ months.
Nature of Crop.—First ratoon.
Harvested.—October, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	44·32	13·90
Eros	38·36	16·10
Q.54	25·26	16·60

SUMMARY OF RESULTS ON SEVEN FARMS.

Variety.	Plant Crop.		First Ratoon Crop.		Summary of two crops.	
	Average Cane per Acre.	Average Sugar per Acre.	Average Cane per Acre.	Average Sugar per Acre.	Total Cane per Acre.	Total Sugar per Acre.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Trojan ..	**40·38**	**5·56**	**31·24**	4·55	**71·62**	**10·11**
Eros ..	32·68	4·75	31·09	**4·70**	63·77	9·52
Q.54 ..	34·48	5·12	22·17	3·49	56·65	8·61

DISCUSSION.

This dispersed trial was originally laid down on eight farms. In the plant crop six of the dispersed units were harvested and in the first ratoon, eight. The average of all farms and of both crops indicated with no uncertainty that Trojan was the superior cane. In the ratoons Trojan and Eros were both significantly superior to Q.54, which is not a satisfactory ratooner. This variety is a shy stooler but its large stalks appear attractive. The sugar content of Q.54 was higher than the other varieties in most cases, and in total sugar per acre its performance was satisfactory. However, no further propagation of the cane is planned in the face of the above results.

Dispersed Varietal trial on farms of Hutchings Bros. and Richards, Hanson and Son, and G. H. Smith and Sons.

Hutchings Bros. and Richards, Ayr.

Soil Type.—Grey alluvial loam. **Nature of Crop.**—Plant.
Age of Crop.—14 months. **Harvested.**—June, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	42·70	14·84
Pindar	43·52	15·91
H.Q.426	31·53	16·70
N.G.15	28·20	15·55
B.212	23·76	14·73

Hanson and Son, Home Hill.

Soil Type.—Grey alluvial loam. **Nature of Crop.**—Plant.
Age of Crop.—15 months. **Harvested.**—July, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	73·73	13·28
Pindar	69·79	15·69
H.Q.426	64·72	16·89
N.G.15	61·35	13·43
B.212	48·03	15·59

G. H. Smith and Sons, Ayr.

Soil Type.—Grey alluvial loam. **Nature of Crop.**—Plant.
Age of Crop.—13½ months. **Harvested.**—June, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons	Per cent.
Troja-	53·70	12·48
Pindar	57·40	13·80
H.Q.426	36·90	14·36
N.G.15	38·60	13·80
B.212	35·90	14·83

SUMMARY OF RESULTS ON THREE FARMS.

Variety.	Cane per Acre.	Average Sugar per acre.
	Tons.	Tons.
T.ojan	**57·04**	7·66
Pindar	56·90	**8·27**
H.Q.426	44·38	7·17
N.G.15	42·72	5·98
B.212	35·90	5·44

DISCUSSION.

On each of the three farms H.Q.426, Pindar and Badila gave the best germinations, while Trojan and B.212 were ten per cent. lower. All plots were supplied and during the summer months the varieties made excellent growth. Pindar and Trojan appeared to be ahead at all stages and the latter variety, as is usual, made considerable late growth. B.212 and Badila slowed down in the later months and H.Q.426 was recumbent in certain plots. The sugar per acre figures showed that Pindar exceeded Badila and B.212 at the one per cent. level while Trojan was superior to B.212. Trojan also exceeded Badila at the five per cent. level of significance, while H.Q.426 was better than B.212 at this level. It would appear that these two new varieties are much more vigorous than the Badila, H.Q.426 and B.212 but do not produce much more sugar than H.Q.426 when harvested early in the season. For early harvesting Pindar was the most successful variety.

G. H. Edwards, Proserpine.

Soil Type.—Black alluvial sandy loam. **Nature of Crop.**—Plant.
Age of Crop.—13 months. **Harvested.**—August, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre.
	Tons.	Per cent.	Tons.
Q.50	**39·57**	15·85	**6·27**
Pindar	34·79	16·73	5·82
P.O.J.2725	28·74	14·11	4·06
Eros	27·71	**17·62**	4·88
Comus	26·91	16·00	4·30
H.Q.426	24·10	16·78	4·04

DISCUSSION.

Germinations in this trial were good although Eros was not so high as the others. It was desired to assess the relative values of these six early canes in the Proserpine area and to determine the best for those conditions. Comus was the best starter with Q.50 and Pindar also very vigorous but all canes showed distress in the dry November period. The trial was spray irrigated late in that month and subsequently growing conditions were good. P.O.J.2725 arrowed heavily in May and later all other varieties except Pindar arrowed to a fair extent. At harvest Eros was difficult to burn. The results show Q.50 in a good light in respect of both cane and sugar per acre with Pindar second in both respects. Q.50 significantly exceeded P.O.J.2725 and H.Q.426 at the one per cent. level in sugar per acre and Comus, P.O.J.2725 and H.Q. 426 at the five per cent. level. The results of the ratoon crop will be awaited with interest.

B. Graham, Pleystowe, Mackay.

Soil Type.—Brown sandy alluvial. **Nature of Crop.**—Plant.
Age of Crop.—15 months. **Harvested.**—September, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre.
	Tons	Per cent.	Tons.
Q.50	**49·70**	**15·92**	**7·91**
Comus	44·21	10·99	4·86
P.O J. 2725	43·46	12·19	5·30
B.174	43·09	13·55	5·84
Eros	41·12	14·58	6·00
H.Q.426	38·16	14·60	5·57

DISCUSSION.

Good planting conditions were experienced and germinations ranged from 85 to 92 per cent., Eros being the only variety with less than 90 per cent. strike. Comus and B.174 were the best early growers but all varieties grew vigorously from January to May. At harvest H.Q.426 was in poor condition as a result of the dry winter and spring while P.O.J.2725 and Comus had a small percentage of dead stalks. Red rot was apparent in Eros, Q.50 and H.Q.426. The harvesting figures showed Q.50 to advantage in both cane and sugar per acre; it was significantly superior to Eros and H.Q.426 in cane per acre at the one per cent. level and was better than all except Comus at the five per cent. level. The very low sugar content of Comus and P.O.J.2725 is difficult to explain but was probably associated with the very dry weather prior to harvesting.

J. C. Rasmussen, Sarina.

Soil Type.—Brown sandy loam. **Nature of Crop.**—First ratoon.
Age of Crop.—12 months. **Harvested.**—October, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Plant Crop.		First Ratoon.		Summary.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.	Total Crop.	Total Sugar per Acre.
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Tons.
Q.50 ..	**41·70**	18·56	**23·48**	17·56	**65·18**	**11·86**
A.130 ..	36·30	17·26	21·27	16·54	57·57	9·78
A.147 ..	29·58	18·16	17·18	17·21	46·76	8·33
Trojan ..	30·34	**18·69**	15·73	**17·62**	46·07	8·44
Q.28 ..	27·33	18·15	15·45	16·89	42·78	7·57

DISCUSSION.

In the plant crop of this trial Q.50 was significantly better than all other varieties and A.130 exceeded the remaining three. After harvesting the plant crop all varieties ratooned well but A.130 and A.147 showed most early vigour; Q.28 was erratic. Growth was good in all plots during the rainy season but Q.28 showed some symptoms of ratoon stunting disease and its yield is no doubt affected thereby. Arrowing was heavy in June in A.130, A.147 and Q.50 but all varieties were sound at harvest. The summarized results show Q.50 in a very favourable light with nearly 12 tons of sugar per acre for the two crops. Varietal improvement in Mackay will be very difficult in the future with a cane of such high productive capacity as a standard of performance.

Sugar Experiment Station, Mackay, Block A.4.

Soil Type.—Grey clay loam. **Nature of Crop.**—Plant.
Age of Crop.—13 months. **Harvested.**—October, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre.
	Tons.	Per cent.	Tons.
Q.50	**31·31**	16·94	**5·30**
F.124	30·43	14·88	4·55
F.186	25·70	16·05	4·14
Q.28	24·40	14·62	3·59
F.184	22·57	14·70	3·34
F.160	21·86	16·70	3·66
F.135	17·90	**17·04**	3·05

DISCUSSION.

Germination in this trial was not satisfactory and all varieties were supplied heavily. During the dry spring very little development took place and it was not until January, when seasonal rains began, that the cane showed signs of reasonable growth. During the next four months a satisfactory stand of cane became apparent and it was obvious at all stages that Q.50, F.124 and F.186 were ahead of the other varieties. At harvest both Q.50 and F.124 significantly exceeded F.135, F.160 and F.184 at the five per cent. levels and F.135 at the one per cent. level. In terms of sugar per acre the superiority of Q.50 over F.135 and F.184 was even more marked. Q.28 was not impressive in this trial and it was significantly exceeded by Q.50 in tons of sugar per acre.

Sugar Experiment Station, Mackay, Block C.3-6.

Soil Type.—Grey loam.
Age of Crop.—13 months.
Nature of Crop.—Plant.
Harvested.—October, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre.
	Tons.	Per cent.	Tons.
Q.50	**25·67**	**15·88**	**4·09**
Pindar	25·07	15·72	3·94
Co.301	22·92	15·28	3·50
Q.49	22·41	14·28	3·21
C.P.29/116	21·31	15·50	3·30
Q.47	20·16	15·37	2·90

DISCUSSION.

Germination was good in all varieties, ranging from 88 to 92 per cent. Until December growth in all varieties was poor although Q.50, Pindar and C.P.29/116 were ahead of the others. From January to May growth was good but in June some arrowing occurred in all varieties. Q.50 had the greatest length of cane and it appeared to be the heaviest crop. At harvest time both Q.50 and Pindar exceeded C.P.29/116, Q.47 and Q.49 at the five per cent. level of significance while Q.50 was superior to Q.47 and Q.49 at the one per cent. level. There was no significant difference between Q.50, Pindar, and Co.301 either in cane or sugar per acre.

Sugar Experiment Station, Bundaberg, Block A.2.

Soil Type.—Red volcanic loam.
Age of Crop.—12 months.
Nature of Crop.—Plant.
Harvested.—August, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre
	Tons.	Per cent.	Tons.
F.18	**29·60**	12·70	**3·76**
F.16	29·30	12·75	3·73
F.31	28·30	11·95	3·38
F.35	27·39	14·20	3·89
F.27	26·89	13·90	3·74
Q.49	24·98	13·50	3·37
F.49	24·38	14·30	3·48
F.14	24·18	13·50	3·26
F.25	23·98	14·70	3·52
F.33	22·78	13·10	2·98
F.60	22·68	**16·30**	3·47

DISCUSSION.

This selection of F. seedlings germinated irregularly, the percentage strike varying from 66 to 86 per cent. The standard, Q.49, gave the highest germination with 86.8. Conditions were very dry and no growth was noticeable until January, after which all canes made good progress in the ensuing months. There was no outstanding cane in the trial and F.18 was the only variety to exceed Q.49 at the one per cent. level of significance. The future of any of these canes will depend on the results of the ratoon crop but it does not appear at this juncture that any cane of real promise is present in this group.

Sugar Experiment Station, Bundaberg, Block B.3.

Soil Type.—Red volcanic loam. **Nature of Crop.**—Plant.
Age of Crop.—16 months. **Harvested.**—August, 1949.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre.
	Tons.	Per cent.	Tons.
C.P.29/116	**31·70**	11·2	3·55
Q.47	30·33	15·5	**4·70**
Q.49	25·66	14·2	3·64
Pindar	21·29	**17·0**	3·62

DISCUSSION.

This represents the first varietal trial at Bundaberg in which Pindar has featured. It was planted at an unusual time—in mid April—owing to the late arrival of Pindar plants from Ayr but all setts were dipped in a mercurial solution to ensure germination under the cool conditions. Strike varied from 88 to 92 per cent. and a good stand resulted. Pindar showed most distress in the dry spring and summer but made good growth with the advent of rains. C.P.29/116 and Q.47 were ahead at all stages. At harvest the high sugar content of Pindar made up a lot of its deficiency in tonnage of cane but Q.47 was well ahead in sugar per acre, and exceeded all other varieties at the one per cent. level of significance. Q.47 is undoubtedly a good variety for South Queensland under dry and irrigated conditions although Pindar may be preferred on certain soils, particularly if the early sugar characteristics persist.

"THE SUGAR EXPERIMENT STATIONS ACTS, 1900 TO 1948."

List of Varieties of Sugar Cane Approved for Planting in 1950.

Department of Agriculture and Stock,
Brisbane, 4th January, 1950.

Mossman Mill Area.

Badila, Cato, Clark's Seedling, Comus, D.1135, H.Q.409, Korpi, P.O.J.2878, Pompey, Q.44, S.J.4, and Trojan.

Hambledon Mill Area.

Badila, Badila Seedling, Cato, Comus, D.1135, Eros, Pindar, Pompey, Q.44, Q.50, and Trojan.

Mulgrave Mill Area.

North of Fig Tree Creek.

Badila, Badila Seedling, Cato, Comus, D.1135, Eros, H.Q.426, Pindar, P.O.J.2878, Q.44, Q.50, and Trojan.

Babinda District.

Badila, Badila Seedling, Cato, Clark's Seedling, Comus, Eros, Pindar, Q.44, and Trojan.

South of Russell River.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Q.44, S.J.4, and Trojan.

Babinda Mill Area.

Badila, Badila Seedling, Cato, Clark's Seedling, Comus, Eros, Pindar, Q.44, and Trojan.

Goondi Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Pompey, Q.44, S.J.4, and Trojan.

South Johnstone Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Q.44, S.J.4, and Trojan.

Mourilyan Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Q.44, S.J.4, and Trojan.

Tully Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Q.44, and Trojan.

Victoria Mill Area.

Badila, Eros, Orion, Pindar, P.O.J.2878, and Trojan.

Macknade Mill Area.

Badila, Eros, Orion, Pindar, P.O.J.2878, and Trojan.

Invicta Mill Area.

North of Townsville.

Badila, Comus, Eros, H.Q.409, Pindar, P.O.J.2725, Q.10, S.J.2, and Trojan. The variety Clark's Seedling may be planted only in the section south of Cattle Creek.

South of Townsville.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2714, S.J.2, S.J.4, S.J.16, and Trojan.

Pioneer Mill Area.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2878, S.J.2, S.J.16, and Trojan.

Kalamia Mill Area.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2878, S.J.2, S.J.16, and Trojan.

Inkerman Mill Area.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2878, S.J.2, S.J.16, and Trojan.

Proserpine Mill Area.

Badila, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Cattle Creek Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J. 2725, P.O.J.2878, Q.28, Q.45, Q.50, S.J.2, and Trojan.

Racecourse Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Farleigh Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, S.J.2, and Trojan.

North Eton Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Marian Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J. 2725, P.O.J.2878, Q.28, Q.45, Q.50, S.J.2, and Trojan.

Pleystowe Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Plane Creek Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, P.O.J.2714, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Qunaba Mill Area.

C.P.29/116, Co.290, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49 and Q.50.

Millaquin Mill Area.

C.P.29/116, Co.290, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49 and Q.50.

Bingera Mill Area.

Atlas, C.P.29/116, Co.290, Mahona, P.O.J.2725, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, and Q.50.

Fairymead Mill Area.

C.P.29/116, Co.290, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, and Q.50.

Gin Gin Mill Area.

C.P.29/116, Co.290, Co.301, Mahona, M.1900 Seedling, P.O.J.2714, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50, and Q.813.

Isis Mill Area.

C.P.29/116, Co.290, Co.301, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50 and Q.51.

Maryborough Mill Area.

Pialba District.

C.P.29/116, Co.290, Co.301, P.O.J.213, P.O.J.2878, Q.42, Q.47, and Q.49.

Maryborough District.

C.P.29/116, Co.290, Co.301, M.1900 Seedling, P.O.J.213, P.O.J.2878, Q.42, Q.47, and Q.49. Q.25 may be planted only on those farms loading cane at sidings on the North Coast Line from Mungar South.

Mount Bauple Mill Area.

C.P.29/116, Co.290, M.1900 Seedling, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, and Q.49.

Moreton Mill Area.

Atlas, C.P.29/116, Co.290, Q.28, Q.42, Q.47, Q.49, Trojan, and Vesta.

Rocky Point Mill Area.

C.P.29/116, Co.290, H.Q.285, Oramboo, P.O.J.2878, Q.28, Q.42, Q.47, Q.49, Q.813, and Trojan.

NORMAN J. KING,
Director of Sugar Experiment Stations.

"THE SUGAR EXPERIMENT STATIONS ACTS, 1900 TO 1948."

Department of Agriculture and Stock,
Brisbane, 4th January, 1950.

APPROVED FODDER CANES.

ALL farmers are advised that the following are the varieties of cane which may be grown for fodder purposes in the sugar mill areas as set out below—

Hambledon and Mulgrave Mill Areas.

China, Uba, Co.290, and "Improved Fodder Cane."

Mossman, Babinda, Goondi, South Johnstone, Mourilyan, Tully, Victoria, Macknade, Invicta, Pioneer, Kalamia, and Inkerman Mill Areas.

Uba, Co.290, and "Improved Fodder Cane."

Proserpine, Cattle Creek, Racecourse, Farleigh, North Eton, Marian, Pleystowe, and Plane Creek Mill Areas.

China, Uba, and "Improved Fodder Cane."

Qunaba, Millaquin, Bingera, Fairymead, Gin Gin, Isis, Maryborough, Mount Bauple, Moreton, and Rocky Point Mill Areas.

90 Stalk. "Improved Fodder Cane," and C.S.R.1 (also known as E.G.).

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REDUCTION IN PRICE OF BENZENE HEXACHLORIDE.

In the face of rising costs in most sections of the industry growers will appreciate the news that a number of firms have recently announced substantial reductions in the price of benzene hexachloride, an insecticide which has proved so outstandingly successful in recent years for the control of cane grubs and wireworms. Quotations received indicate that different suppliers are prepared to sell at the following rates in respect of the 1950 requirements:—

> 10 per cent. B.H.C. dust 9½d. lb., and 20 per cent. B.H.C. dust 1/0½d. lb. both net in 5-ply and/or sisalkraft bags ex Cairns store and Brisbane store, whilst another supplier has quoted the 10 per cent. B.H.C. dust at 8½d. lb. in quantity shipments, net f.o.b. Sydney.

Most growers are more familiar with this product under the name of "Gammexane," which is the trade name used exclusively by one firm. This was the only brand of benzene hexachloride available in Queensland as late as June, 1949, but during the past six months a number of other firms have entered the field of manufacture and have supplied various quantities under the names of "Rudust No. 13 and No. 14," "Gamma-di," B.H.C. 10 per cent. dust, and so on. Their combined efforts contributed substantially in fulfilling on time the whole of last season's huge orders, which continued to pour in as grub damage became more evident with the onset of drier conditions. In all, approximately 900 tons of 10 per cent. dust, or the equivalent, were supplied to Cane Pest and Disease Control Boards during the past season, this quantity representing an outlay of over £90,000 by growers or their organisations.

From time to time we have witnessed the meteoric rise of different sugar cane varieties such as Q.28, Trojan, Pindar and Q.50, but the sudden rise in popularity of benzene hexachloride which has been supplied in rapidly increasing amounts from a mere few pounds used exclusively for experimental purposes by the Bureau in 1945 to 900 tons used predominantly on a commercial basis in 1949, is none the less impressive. As a result of this continued demand for benzene hexachloride which looks like tapering off at a fairly high yearly level, different firms have been able to organise their output more efficiently and introduce certain economies in manufacture.

At least one firm proposes to erect a blending plant at Cairns, and it is expected that distribution will be made from that centre early in 1950. This will mean that the B.H.C. dusts will be manufactured not far distant from the areas wherein the greatest demand exists and in this way a considerable saving in freight charges will also result. Moreover, it will be appreciated that such a venture will be freer from shipping hazards whilst reduced handlings should result in fewer torn or burst containers.

—R.W.M.

A. H. TUCKER, Government Printer, Brisbane.